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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

19 — The Chemical Nature of the Vitamines. Isomerism in Natural Antineuritic Substances (1). — WILLIAMS, ROBERT, R. and SEIDELL, ATHERTON (Bureau of Chemistry, U. S. Dept. of Agriculture), in *The Journal of Biological Chemistry*, Vol. XXVI, No. 2, pp. 431-436, 5 Diagr. + 1 Plate, Baltimore, Md., September, 1916.

RURAL  
HYGIENE

Recent investigations by WILLIAMS (*Journal of Biological Chemistry*, 'ol. XXV, p. 437, 1916) demonstrated a dynamic isomerism in the hydroxypyridines which has a most profound influence upon the antineuritic properties of these substances. This fact suggested that a similar isomerism may exist in the natural "vitamines" and be responsible for the instability which has so far prevented their isolation. With this conception in mind the authors directed attention to the natural antineuritic substances of yeast and obtained results which strengthen the conjecture that an isomerism plays a determinative part in the physiological action of the natural "vitamines" not less striking than in the hydroxypyridines.

A great obstacle confronting previous investigators of "vitamines" has been the difficulty of securing adequate amounts of sufficiently concentrated products for experimental study. Since SEIDELL (*U. S. Pub. Health Reports*, Vol. XXXI, p. 364, 1916) has shown that the antineuritic substances of autolyzed yeast are completely adsorbed and retained in a physiologically active condition by fuller's earth, the authors considered that this solid combination of relatively pure "vitamine" and an inert inorganic substance, would offer greater advantages for this study than any product previously available. There is practically no loss of active "vitamine"

(1) As regards vitamines and their importance in feeding, see: — *B.* 1912, No. 115; 14, No. 871; 1913, No. 1239; *R.* 1916, Nos. 612 and 1254; 1917, Nos. 163 and 260; 18, Nos. 24, 62, 125, 182, 315, 316, 377, 501, 616, 657, 668; 782 and 784 of this *Review*. (*Ed.*)

in the process of "activating" the solid and the small amounts of other substances adsorbed simultaneously with the "vitamine" do not appear to be of noteworthy consequence.

The results of the experiments described in this paper were the following:—

The physiological properties of autolyzed yeast filtrate were not appreciably altered by treatment with relatively concentrated caustic alkali.

In the case of fuller's earth "activated" by contact with autolyzed yeast filtrate, aqueous alkali modified the physiological action in respect to its power to maintain the weight of pigeons on a deficient diet, but did not sensibly affect its antineuritic function.

By alkaline extraction of "activated" fuller's earth a crystalline antineuritic substance was obtained, the physiological action of which was apparently not due to adhering mother liquor. On attempting to purify this substance further by re-crystallization, its antineuritic properties were lost and the resulting product was found to be identical with adenine. By suitable treatment of the resulting adenine, it acquired antineuritic properties, and the power to give a blue color with the Polin-Macallum reagent. The explanation of the results obtained appears to be that an isomer of adenine is the chemical entity responsible for the characteristic physiological properties of the "vitamine" under investigation.

*Theoretical Considerations concerning the Chemical Nature of "Vitamines".* — Numerous writers have held the view that the "vitamines", by which term the writers mean certain constituents of untreated food-stuffs, are complex compounds.

Accordingly various investigators have submitted products to autolysis with mineral acids as a preliminary to chemical investigation, the object of such treatment being to reduce the complex natural compounds into simpler ones which possess at least the more essential physiological characteristics of the parent substances. That hydrolysis with mineral acids does effect some change in the "vitamines" is definitely proved by the fact that extract of rice polishings, after hydrolysis, has a distinctly altered physiological action, being much more efficacious as a curative agent than the original extract. It is only reasonable to suppose that this change results from cleavage of the original molecules. The evidence which the authors have obtained regarding the effect of alkalis on "activated" fuller's earth suggests that the alteration of physiological properties observable in this case is possibly due to a different type of cleavage. (They recognize that this change in properties is equally well accounted for by other assumptions, such as that of the existence of two types of "vitamines" only one of which is destroyed by alkali).

Further, they have given evidence that "vitamines" can be reduced to still simpler compounds which are physiologically active. Although the antineuritic properties of foodstuffs and of crude extracts persist through long periods of storage, it has been the experience of investigators who have attempted to isolate the "vitamines" that the final relatively purified fractions are apparently much less stable, since simple re-crystallization may

often serve to destroy the curative property. In this paper it is shown that certain fractions of yeast may automatically lose their curative property when they are allowed to stand a few days at ordinary temperature.

These facts suggest the following hypothesis which is in part a re-statement of old conceptions. The "vitamines" contain one or more groups of atoms constituting nuclei in which the physiological properties are resident. In a free state these nuclei possess the "vitamine" activity and under ordinary conditions are spontaneously transformed into isomers which do not possess antineuritic power. The complementary substances or substituent groups with which these nuclei are more or less firmly combined in nature exert a stabilizing and perhaps otherwise favourable influence on the curative nucleus but do not in themselves possess the "vitamine" type of physiological potency. Accordingly it is believed that while partial cleavage of "vitamines" may result only in a modification of their physiological properties, by certain means disruption may go so far as to effect a complete separation of "nucleus" and "stabilizer", and if it does so will be followed by loss of curative power due to isomerization. The basis for the assumption that an isomerization constitutes the final and physiologically most significant step in the inactivation of a "vitamine" is found in studies of synthetic antineuritic products. This assumption is supported by evidence, presented in this paper, of the existence of such an isomerism in the crystalline substance.

If the above hypothesis concerning "vitamines" is fundamentally sound there are two possible successful issues of a study of the alkaline extract of activated fuller's earth; first to crystallize a free or combined curative nucleus before it has opportunity to isomerize into a non-curative substance; or, second, to isolate this nucleus in an inactive form and convert it into the active isomer, thus proving that it is related to the original antineuritic substance. Experiments described in the paper analysed show a measure of success has been attained in both of these directions.

720 - **Experimental Studies on the Food Value of Bran, in France (1).** — LAPIQUE, L. and CHAUSSIN, J., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXI, No. 7, pp. 319-323. Paris, April 13, 1918.

The present percentage of flour extraction in France is between 82 and 83 %; if 85 % extraction were again adopted would the 2 or 3 % of extra flour obtained be only an inert mass, or, given that this addition increases the amount of food substance, would the benefit in food material be lost by the increased work of the intestines?

The authors previously studied experimentally on man the food value of wheat flour containing slightly more husk than white flour and found no difference in their food values (2). They again studied this question in the following form which seemed to them more conclusive:—the subject was placed on a strict maintenance diet, the greater part of which was composed of flour containing the debatable product, which was removed

(1) See *R.* 1918, January, No. 3; February, No. 210; March, No. 344; April, No. 379.—  
(2) See *R.* April 1918, No. 379. (E.L.)

later on; if the product is really useless maintenance will still continue.

The subject chosen was a dog, and it was found that when the bran was withdrawn from the ration gradual starvation occurred. Consequently bran (including the products of commercial milling which are discarded in an 80 % extraction but included in a 90 % flour) is decidedly nutritious for a carnivorous animal like the dog and obviously much more so for man.

**721 - Determination of the Indigestible Residue *in vitro* by the Action of Pancreatin on Wheat or its Milling or Baking Products.** — DEVILLERS, L., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 17, pp. 700-702, Paris, April 29, 1918.

Investigations into the utilisation of wheat as a food have shown the inaccuracy of the proportion of wheat believed to escape assimilation in man.

As chemical methods attack wheat by too diverse actions, by forces having an action different to that of the digestive juices, and physiological methods were impracticable because of their slowness, artificial digestion was resorted to. The author describes his method of digestion by Defresne's pancreatin in the presence of sodium borate, crystallised calcium chloride, hydrochloric acid and distilled water.

The residue undigested by the pancreatin reduced to 100 parts of product dried at 105-110° was 8.26 to 12.86 for the wheats tested, 35.22 for the bran (sharps), 4.87 to 8.17 for the flours analysed, and 7.53 to 8.24 for the bread.

**722 - *Phymata noualhieri*, a Hemipterous Enemy of *Musca domestica* in Mexico.** — DE LA BARREDA, L., in *La Revista agrícola, Órgano oficial de la Dirección de Agricultura, Secretaría de Fomento*, México, Vol. 1, No. 7, pp. 281-284 + 1 Fig. Mexico, December 1, 1917.

At the Agricultural Station of Oaxaca (Mexico) the author observed that a branch of "lila" (*Melia sempervirens*) infested with larvae of *Phymata noualhieri* was soon covered with numerous dead flies. He bred the hemipteron, which hunted flies energetically. It is also possible that it kills them by some poisonous secretion.

**723 - A First Year Course in Home Economics for Southern Agricultural Schools in the United States.** — STANLEY, L., in *U. S. Department of Agriculture Bulletin* No. 510 pp. 1-58, Washington, D. C., July 27, 1917.

This bulletin outlines a course of study in home economics for southern high schools of the United States.

It emphasizes the connection between such instruction and actual home experience and the danger arising from formal methods of presentation. It calls attention to underlying general principles and applies them in a typical course of study, which, while based on southern conditions is applicable in other communities.

The principles involved in the 160 lessons set forth in this publication are fundamental; however, to secure the best results with this work, teachers should make a special effort to adapt the lessons to the conditions found in the homes of the pupils.

A complete course in home economics, as outlined by the American

Home Economics Association of Baltimore would include the following subjects:—

1) *Food*: (a) Selection (home-grown and purchased food). (b) Preparation. (c) Planning and serving of meals. 2) *Shelter*: (a) House sanitation. (b) Planning of house. (c) Decoration and furnishing of the house. (d) Care of the house. 3) *Clothing*: (a) Selection. (b) Making. (c) Keeping in repair. (d) Laundry work. 4) *Care and training of children*. (a) Care of a baby. (b) Problems of a young child. (c) Amusements for children. 5) *Hygiene and sanitation*: (a) Definition of health. (b) Definition and classification of diseases. (c) Means of preserving health. 6) *Home care of the sick*. 7) *Household management, including systemization of housework, expenses, accounts*. 8) *Training for the enjoyment of leisure time*.

*Outline of lessons.* — The following order has been used for each of the 160 lessons outlined in this bulletin: 1) The subject, stated as a "Problem". 2) The chief ideas, listed as Points to be brought out. 3) The references, which have been confined to material available in bulletins of the U. S. Department of Agriculture and of the various State colleges and experiment stations. 4) Under "Correlation" are suggested ways in which other courses may make use of home-economics subject matter.

724 — **Experimental Projects of the Division of Pomology of the University of California.** — HOWARD, W. L., in the *Monthly Bulletin of the California State Commission of Horticulture* (Proceedings of the 50th State Fruit Growers' Convention), Vol. VII, Nos. 1 and 2, pp. 62-64. Sacramento, California, January-February, 1918.

The total number of official experimental projects, in the Division of Pomology of the University of California, amounted in the autumn of 1917 to 24. Not all are located at Davis; 4 are at Berkeley, and parts of others are out in the state, namely near Gilroy, Rucker, San Jose, Vacaville, Watsonville and Hayward.

There are now on the experimental farm 55 acres of fruits used for experimentation and instruction. Experimental investigations cover pruning studies with young and old apricot trees, different methods of pruning bearing prune trees, pruning young and bearing peach trees, pruning of old and young apple and pear trees, training and shaping young apricot, cherry, plum, prune, peach and pear trees. Experiments in the summer pruning of both young and old trees are also in course.

Pollination studies include cherries, almonds, prunes, plums and pears.

The almond project consists of experiments at Davis and systematic observations over the whole state. A series of orchard soils investigations is also in progress. One part of this investigation consists of a tillage and cultivation experiment. Another part has to do with the improvement of orchard soils by means of mulching with straw and manure instead of cultivation, the tillage experiments being carried on at Davis while the mulching work is located both at Davis and in several orchards near Rucker and Gilroy.

An experiment in orchard irrigation is being carried on at Davis in co-operation with the irrigation division of the University. Peaches are being studied first; later other fruits will be added. One of the larger long-

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time experiments is being carried on at Davis to determine the best or most profitable distance apart for planting apricots, cherries, peaches, pears, plums and prunes. The yield record of the orchard covering a period of 15 or 20 years or longer will determine the best or most profitable planting distances.

The cold storage studies with deciduous fruits are being carried on at Berkley. These include the keeping qualities of grapes held at different cold storage temperatures, keeping qualities of pears in cold storage, and the keeping qualities of apples in cold storage as affected by the health and vigour of the trees and also by the stage of ripeness at harvesting time. The new Agriculture Building, Hilgard Hall, at Berkley, has the best experimental cold storage plant in the United States.

Six new projects deal with fruit drying problems. These include a survey of the fruit drying industry of the state; variety tests of fruits for drying purposes; standardization of fruit drying methods, equipment for drying, effects of finishing in the shade by stacking the trays, and effects of sulphuring on fruit tissue and its possible relation to palatability of product. Extensive data along these lines were collected during the last season.

At Davis extensive studies of fruit bud development are in course.

Special studies are being made with walnuts, pecans, chestnuts, filberts and pistachio nuts.

Variety tests of all kind of fruits are being made. The best collections of varieties are: peach 85, apricot 40; cherry 40; almond 30; pear 30.

Under miscellaneous experiments might be mentioned work in spraying; various tests with small fruits, including both bush fruits and strawberries; individual trees performance records; a collection of phenological data with all fruits; trials with tree washes against borers and rabbits, washes for protecting pruning wounds, etc.

The division keeps an individual record in map form and card index form for every fruit tree that is growing in the University Farm orchards. The orchards are being conducted both for experimental and instruction purposes.

#### CROPS AND CULTIVATION.

725 — Agricultural Meteorology in New Castile, Spain.—QUINTANILLA, G., in the *Boletín de Agricultura Técnica y Económica*, Year X, No. 110, pp. 115-132, Madrid, February, 1918

The average yield per acre of cereals in New Castile is:—wheat, 5.80 cwt., barley, 10.74 cwt., oats, 6.29 cwt., and rye, 6.03 cwt. The figures for the province of Cuenca alone are:—wheat, 4.93 cwt., barley 9.66 cwt., oats and rye, 4.38 cwt.

The ignorance of the farmers, the absence of modern machinery and chemical fertilisers are not sufficient to explain these remarkably poor crops. The primary cause is to be found in the unfavourable climatic conditions. Spanish emigrants, especially Castilians, in a more favourable climate, with the same labour, tools, and methods produce at least double the quantity of wheat as in their own country. Agricultural meteorology

the importance of which is recognised throughout the world, assumes an especially urgent character in Spain.

The following data are available on the weather conditions of New Castile:—

TEMPERATURE. — Fundamental characteristics:— short growing season and considerable annual variations in temperature. The author calls "persistent" frosts those which occur regularly each year, "rare" those which occur less frequently, *i. e.*, one in every two, three, or four years on the average.

In the province of Guadalajara "persistent" frosts occur from November to April, "rare" frosts occur in October and May. In the province of Cuenca "persistent" frosts continue from November to May and "rare" ones occur in October and June. Only the months of July, August and September are consistently free from frost. In the province of Madrid "persistent" frosts occur from November to April, and, more rarely, occur also in October and May. At Toledo the duration of frosts is from November to March, and the season consistently frost-free includes the months of May, June, July, August and September.

The short frost-free season (the conditions in the province of Cuenca are very similar to those of northern Sweden) suffers seriously from drought, marked annual variations, and frequent very high temperatures. The maximum and minimum temperatures for the last 5 years are:— Madrid  $+40.5^{\circ}$  and  $-14^{\circ}$  C.; Cuenca  $+38.5^{\circ}$  and  $-12.5^{\circ}$  C.; Toledo  $+40.4^{\circ}$  and  $-6.5^{\circ}$ ; Guadalajara  $+39.6^{\circ}$  and  $-13^{\circ}$ .

RAINFALL. — Madrid, 417 mm.; Cuenca, 477 mm.; Toledo, 361 mm.; Guadalajara, 410 mm. This would be a sufficient amount of rain if it were evenly distributed, and would ensure a good cereal harvest. The distribution of the rain does not, however, always correspond to the requirements of the crops, and frequently the lack of water at the critical period (earing for cereals) contributes not a little to a low yield. The weather conditions most unfavourable to crops in Spain are, therefore, frost and drought. In order to control these factors it is above all necessary to know exactly their distribution and frequency so as to choose the most suitable varieties, determine the periods for ploughing, etc. The attention of the Minister of Agriculture, of the Society of Spanish Agriculturists and of all agricultural societies, is drawn to the interest presented by this subject and the formation of a service with a technical staff and equipment, fitted to deal with the problems so closely touching Spanish agriculture is demanded. Methods of dealing with the climatic and agro-geological conditions of the Peninsula are also suggested.

CHOICE OF RESISTANT TYPES. — By selection and hybridization there have been obtained in Sweden, Canada, the United States, etc., types of wheat, barley and oats particularly resistant to low temperatures. Acclimatization experiments in Spain with Russian and American varieties have given almost entirely negative results. In Spain, as elsewhere, it would probably be wiser to use local varieties, apply pure strain selection first and eventually improve them by hybridization and selection. Among the nat-

ive varieties are some six-rowed barleys which have given results superior to those obtained with foreign varieties in all comparative cultural tests.

**PERIOD FOR SOWING.** — Taking as a basis observations made at Alcalá Henares the author, though on the whole in favour of early sowing, finds it impossible to give a fixed date on account of the unsettled weather conditions. In some years the maximum temperature ( $40^{\circ}$  C. in the shade) occurs during the second fortnight in June; in this case sowing should be done as soon as possible so that the wheat may ripen before the great heat. In other years wheat, if sown early, regularly suffers from frost, which attacks the young plants even at a very advanced stage of growth.

**CHOICE OF SOIL AND CULTURAL METHODS.** — Thorough weeding, surface cultivation, the use of chemical fertilisers which increase the concentration of the soil solution, are all efficient methods of controlling drought, but in any case it is essential that the arable layer should have a certain depth below which a good harvest cannot be obtained even if the best methods are adopted.

The author lays stress on the necessity of such examinations of the soil which will immediately give the data by which it is possible to calculate approximately the probability of growing successfully any crop in a country with so unfavourable a climate.

726 — **Orchard Heating Against Frost in Utah, U. S. A.** — WIST, F. J., and EDLESON, N. E., in *Utah Agricultural College Experiment Station, Bulletin No. 161*, pp. 1-47; 2 Figs. *Logan, Utah, October, 1917*

In the States of Florida, Ohio, Washington, Colorado, and California and Oregon in particular, the protection of orchard trees against frost by heating with heavy oil has been adopted on a large scale with distinctly positive results. In Utah, every three years out of ten the fruit crop is reduced by spring frosts, so that the question of protection by heating should not be neglected, but it must first be shown whether it would prove economically practical. To decide this it is necessary to determine for each species of fruit tree:— 1) the average number of times the fires must be lit and the expense entailed; 2) the amount and price of the fruit thus saved. The study made on this subject by the author from data supplied by five of the most important fruit centres (Utah, Box Elder, Salt Lake City, Weber, and Cache) leads to a negative conclusion as is shown by the results given below.

**NUMBER OF TIMES THE FIRES SHOULD BE LIT.** — The critical period for fruit trees with respect to frost coincides with the interval between the beginning of flowering and setting. Table I gives the figures concerning apple, apricot, cherry and peach trees collected by the Agricultural Stations of Provo (Utah), Corinne (Box Elder), Salt Lake City, Ogden (Weber), and Logan (Cache). Table II shows the number of times which, according to the author, it would have been necessary to light the fires. In the case of the peach trees they should be lit an average of three times a year.

**EXPENDITURE AND PROFIT.** — For the peach tree, taking as a basis the calculations drawn up with the greatest care, the total annual expenditure is \$ 50.50 per acre. The average yield is 400 bushels per acre, and the loss

due to frost about 80 bushels (20 %) to a net value of \$ 28 (the average price of peaches on the Utah market is about \$ 0.55 a bushel).

The figures would be slightly better for apple but it must be remembered that in this case too, the number of heatings proposed by the author represents a minimum which would always be much exceeded in reality as a precaution, as is proved in all orchards fitted up with the necessary apparatus.

This study shows that the advisability of heating and fumigating Utah orchards at the present price of fruit and fuel is doubtful, for the benefit obtained would hardly cover or justify the expense, even under the most favourable conditions of good weather forecasting and capable staff.

TABLE I. — *Duration of the interval between the beginning of flowering and setting (average 1900-1916).*

Station	Apricot	Peach	Cherry	Apple
Provo, Utah . . . . .	—	Apr. 1-Apr. 30	—	Apr. 14-May 15
Corinne, Box Elder . . . . .	Apr. 1-Apr. 15	Apr. 6-Apr. 20	Apr. 10-Apr. 30	Apr. 30-May 18
Salt Lake City . . . . .	—	Apr. 14-Apr. 30	—	Apr. 25-May 16
Ogden, Weber . . . . .	—	March 8-March 21	—	Apr. 3-Apr. 19
Logan, Cache . . . . .	—	Apr. 21-May 5	—	May 7-May 18

TABLE II. — *Minimum number of times for lighting the fires each year (average).*

	Provo	Corinne	Salt Lake City	Ogden	Logan	Average for the 5 localities
Peach . . . . .	5.7	2.2	2.2	5.0	0.5	3.1
Apple . . . . .	2.9	0.5	1.0	0.3	0.2	1.0
Apricot . . . . .	—	3.2	—	—	—	3.2
Cherry . . . . .	—	1.5	—	—	—	1.5

727 — **Soil Acidity and the Hydrolytic Ratio in Soils.** — STURWAY, C. H. (Assistant Professor of Soil Physics, Michigan Agricultural College), in the *Journal of Agricultural Research*, Vol. XI, No. 12, pp. 659-672 + Bibliography of 60 Publications, Washington, December 17, 1917.

Recent studies (1) have shown a certain relationship between the acidity of a soil, as shown by a litmus or phenolphthalein indicator, and its content in aluminium and iron compounds. The author's investigations into glacial soils showed a connection between the aluminium and iron salt content of the soils and their reaction to the above-mentioned indicators. In determining for 29 soils the percentage of calcium, iron, aluminium and silica soluble in N/5 hydrochloric acid a definite relationship was found between the ratio of calcium to iron or aluminium soluble in N/5 hydrochloric

(1) See *B. T. J.*, No. 480; *R. T. G.*, Nos. 727 and 1163, (*Ed.*).

acid and the soil reaction. All soils with a ratio  $\frac{\text{lime}}{\text{ferric oxide} + \text{aluminum}}$  exceeding  $\frac{1}{1.3}$  are acid and those in which this ratio is lower are alkaline. There is, therefore, reason to believe that the reaction of the soils studied depends chiefly on the hydrolytic ratio between the hydrolysing compounds of alkali soils and those of iron and aluminium.

It is thus possible to determine the amount of lime required to neutralize acid soils by estimating the amount required to bring the soluble calcium content to the ratio  $\frac{\text{lime}}{\text{ferric oxide} + \text{aluminum}} = \frac{1}{1.3}$ . Amounts calculated by this process are very near to those determined by an indirect titration method proposed by the author, so that the two methods corroborate each other. The new process consists in treating increasing quantities of soil with an invariable quantity of titrated lime water and determining the reaction of the solutions with phenolphthalein and their electrical resistance. The amount of lime required to neutralize an acid soil is independent of its concentration, thus proving neutralization to result from a chemical reaction. Nevertheless soil still absorbs lime after neutralization, but by physical means. It is, however, possible that a mass action may cause chemical reactions in the presence of an excess of lime.

728 - Salts Injurious to Vegetation and their Relationship to the Irrigation of Arid and Semi-arid Regions. -- PERKINS, A. J. (Director of Agriculture), in *Department of Agriculture of South Australia, Bulletin No. 103, pp. 24*, Adelaide, 1916.

Present Australian irrigation areas, and in particular those situated on the banks of the Murray, are under the influence of arid conditions of climate. Land so situated will become exceedingly productive when brought under cultivation and irrigated. Experience throughout the world, however, teaches that all such land, when brought under the influence of irrigation, is liable to become salt-impregnated to the extent of barrenness. At times, when first handled, such land shows no apparent signs of the presence of salt; salt, however, is present, but distributed evenly and invisibly through the depth of several feet of soil. A few seasons subsequent to the application of irrigation, salt may become apparent either uniformly throughout a block, or in scattered patches which gradually increase in area. This salt has risen to the surface through surface evaporation; and, knowing this, it is the business of irrigators to do everything in their power to hinder the action of surface evaporation and hold in check the rise of salt.

Towards this end the tillage of irrigated areas, when given in the way of initial preparation of the soil, must be deep and thorough, infinitely more so than is the case in the average routine of farming. In addition to this, it is essential to keep the surface soil well screened from the direct rays of the sun during the summer months and where circumstances do not permit of this the moister layers of the sub-soil must be kept well protected by a deep layer of soil mulch. Nor should this be forgotten in autumn, when irrigation areas are bare, in the interval that lies between the removal of the summer crop and the seeding of the winter crop.

Over-irrigation, leaky water channels, shallow drainage channels, and the slow removal of salt-impregnated drainage waters must be avoided.

Irrigation waters that are unduly charged with soluble salts must be avoided. Irrigation water showing 20 grains of soluble salts to the gallon, and used on the 3 acre feet basis, will add to the soil annually more than one ton of soluble salts to the acre; 40 grains to the gallon nearly  $2\frac{1}{2}$  tons to the acre and so on. A portion of these salts will no doubt be taken up by the plants; another portion, however, will go towards swelling the existing stocks of injurious salts originally present in the soil.

If, in spite of these precautions, it is impossible to prevent the ultimate rise of salt, or again, if from the outset the land is evidently over-charged with surface salts, special steps towards the removal of the salts must be taken. Whatever steps may eventually be decided upon, none are likely to prove effective unless adequate provision is made for the systematic removal of drainage waters. Naturally, pipe drainage should be avoided if possible. Ultimately, however, in many cases it will be necessary to determine whether the cost of establishing an adequate system of pipe drains is not amply set off by the extremely high productivity of land so treated and irrigated under arid conditions of climate.

If the land shows 0.1 per cent of sodium carbonate if should be treated with gypsum prior to leaching operations. This, however, is a contingency rare in local experience; under Australian conditions the flood waters pass through the soil, dissolve the soluble salts, and convey them without hindrance through the drain pipes into the country drainage.

The profits resulting from properly conducted irrigation operations under Australian conditions of climate are enormous; the indirect advantages to the State as a whole are equally great. If, however, Australian irrigators are not prepared to take into account this important salt question, and to guard themselves adequately against it, all the expenditure of time and capital will in the end prove vain, and the irrigation areas will revert to the condition of those of Mesopotamia.

#### 729 - The Effect of Certain Factors on the Carbon Dioxide Content of Soil Air.

BIZZELL, J. A. and LYON, T. L. (Contribution from the Laboratory of Soil Technology, College of Agriculture, Cornell University, Ithaca, N. Y.), in the *Journal of the American Society of Agronomy*, Vol. X, No. 3, pp. 97-112 + 9 Figs. Washington, March, 1918.

Some higher plants are said to influence certain bacterial processes in the soil, such as stimulating nitrate formation during the most active period of their growth. Later, however, they have a depressing effect, and, since the conditions which favour the formation of carbon dioxide in soils are similar to those favouring nitrification, these two processes may be supposed to be parallel to each other. This is the opinion of many workers (1).

All determinations hitherto made, however, lack uniformity on account of the different conditions under which they were carried out and the various methods employed. The author, therefore, undertook a series of experiments in large lysimeter tanks, which received no other moisture

(1) See R. 1917, No. 795. (Ed.)

that from rain. The samples of air were removed from their drainage tubes. Some of the tanks were filled with clay loam, others with silt loam.

In clay loam oat crops produced great fluctuations in the carbon dioxide content of the soil air. The greatest apparent production was at the flowering period. This was followed by a marked decrease of  $\text{CO}_2$  which appeared to be due to the depressing effect of the crop on the production of  $\text{CO}_2$  by bacterial action.

In silt loam the crop apparently produced little effect on the formation of carbon dioxide, whereas the addition of lime caused a increase in the  $\text{CO}_2$  content of the air of both cropped and uncropped tanks, though in clay loam liming produced no such effect.

In silt loam burnt lime caused a larger production of  $\text{CO}_2$  than the chemically equivalent quantity of ground lime.

The results do not make clear whether the increased  $\text{CO}_2$  production caused by burnt lime is due to a stimulation of bacterial activity or stimulation of the crop.

730 - **The Relation of Weed Growth to Nitric Nitrogen Accumulation in the Soil.** — CALT, L. E., and SWEET, M. C., in the *Journal of the American Society of Agronomy*, Vol. X, No. 1, pp. 35-44 + 7 Tables + Bibliography of 19 Publications. Washington, January, 1918.

The favourable effect of tillage upon nitrification is generally attributed to the incorporation of organic matter, the distribution of bacterial flora, aeration, and moisture. The authors attempt to prove that too much importance has been attached to these factors and that the good effects of tillage are due above all to the destruction of weeds which might absorb the nitrates.

After reviewing the publications on this subject (which show that nitrification is not essentially increased by greater aeration and a higher water content, though these factors are necessary) the authors give the results of various experiments made at the Kansas Agricultural Station during several years on plots of wheat cultivated by eleven different methods. A comparison of the yields, moisture contents and nitrate contents shows that marked differences in yield cannot be attributed to the water content which is nearly always constant, but that there is a close relation between yield and nitrate content. Experiments conducted by the authors themselves showed that the accumulation of nitrates is much larger in soils free from weeds even when such soils are not farmed. They conclude that, in a sufficiently light soil, much labour may be saved by adopting only the essential cultivation processes and destroying the weeds by other methods such as rotation and grazing by livestock, especially sheep.

731 - **Protozoa and the Phenomena of Reduction in Soil (1).** — VON WOLZOGEN KÜHN, JR., C. A. H. (Bacterioloog aan de Cultuurafdeling te Pasoeocean), in *Archief voor de Suikerindustrie in Nederlandsch Indië* No. 27, pp. 1125-1182 + 11 Figs. + Bibliography. Soerabaja, 1917.

The principal biochemical reduction phenomena occurring in the soil and the analytical methods for recognizing them are rapidly reviewed.

(1) See *B.*, 1915, No. 786. (*Ed.*).

When they have reached a certain intensity these reduction phenomena result in changing ferric into ferrous compounds; the best reagent for recognizing these phenomena is potassium ferricyanide. Quantitative determinations include: — 1) the "reduction index" ("reductiegetal"), expressed in cc. of a decinormal solution of  $\text{KMnO}_4$  required to oxidise the quantity of "ferrous" iron liberated by 100 gm. of soil (dried at 105°C.) in a sulphurous solution; 2) the "ferro-index" ("ferro-cyfer"), expressed in cc. of a decinormal solution of  $\text{KMnO}_4$  required to oxidise the "ferrous" iron extracted from 100 gm. of soil (dried at 105°C.) in an acetic solution.

The recent publications on soil protozoology (CUNNINGHAM and LÖHNIS, RUSSEIL, and HUTCHINSON) (1) (FRANCÉ) are reviewed. These studies show that a high water content favours the appearance of protozoa; in the same way as an excessive water content also favours the phenomena of reduction in the soil the presence of more numerous protozoa (amoebae, flagellates, ciliates) may serve as an index to show reduction processes. It is relatively easy to determine the number of protozoa present in 1 gm. of soil, since sterilisation precautions as rigorous as those required when the bacteria are counted are no longer necessary, and many methods have been described (CUNNINGHAM and LÖHNIS, KOCH (2), Kopeloff (3)). The examination of numerous soil samples has shown that, from a point of view of the number of protozoa present and the degree of reduction, soils may be divided into three classes:—

- 1) *Good soils*, showing little or no reduction, containing few or no protozoa (from 0 to 50 protozoa per 1 gm. of soil);
- 2) *Bad soils*, with a high "reduction index" and many protozoa (50 to 100 or more per gram);
- 3) *Very bad soils* with a very high "reduction index" and few or no protozoa (0 to 50 per gram).

It is seen that, as the reduction process continues, the number of protozoa increases, reaches a maximum, then decreases. This phenomenon may be represented graphically by curves called "curves of protozoa reduction" ("protozoenreductiekrommen") specially designed for each of the reduction processes: — cellulose fermentation, reduction of the sulphates and butyric fermentation.

As the protozoa are aerobic, their number increases during the first stages of the reduction phenomena, then they feed on anaerobes and the aeration of the soil is sufficient. As the reduction process continues, the anaerobes increase and the air decreases, till the development of the protozoa is checked and the maximum reached. Finally, during the continuation of reduction, the activity of the anaerobes increases to such an extent that the protozoa decrease more and more and die, being also attacked by the toxic substances formed during reduction, such as volatile fatty acids, sulphuretted hydrogen, etc. The number of protozoa present in 1 gm. of soil can show the reduction process to which the soil is subjected. Butyric

(1) See *B.*, 1915, Nos. 460 and 1250. (*Ed.*) — (2) See, *R.*, 1910, No. 269; — (3) See *B.*, 1915, No. 1122. (*Ed.*)

ferments especially are fatal to protozoa as butyric acid kills them. The reduction curve is also very low (limited number of protozoa). During the reduction of sulphates, however, a large proportion of the sulphuretted hydrogen combines with the iron, the protozoa suffer less and are very numerous.

Protozoa form, therefore, a biological indicator of the reduction phenomena in the soil which the author applied to a large number of soils from sugar-cane plantations in Java. These investigations have shown that there is a relation between the water content, " reduction index ", " ferro-index ", and the number of protozoa per gram of soil.

732—**The Influence of Nitrifying Bacteria on Phosphates.**—HORKINS, C. G. and WHITING ALBERT L., in *University of Illinois Agricultural Experiment Station, Bulletin No. 190* pp. 395-406. Urbana, Illinois, June, 1916.

The purpose of the experiment herein reported was to determine whether the farmer supplying nitrogen to his soil in the form of organic matter could depend upon its decomposition to render soluble the finely ground rock phosphate, and so maintain the necessary supply of available phosphorus. Two experiments were carried on; the first for the purpose of testing the ability of nitrite bacteria to dissolve pure rock phosphate; the second in order to test the effect of nitrate bacteria on pure tricalcium phosphate. The methods of determination consisted in measuring by chemical analysis, in the first instance, the amount of nitrogen which they had changed from ammonia to nitrite, in the second one, the amount of sodium nitrite which they had changed to nitrate, and in both cases the amount of phosphorus and calcium which had at the same time made soluble.

The results are summarized as follows:—

Nitrite bacteria make phosphorus and calcium soluble from insoluble phosphates when they oxidize ammonia into nitrite. About one pound of phosphorus and about two pounds of calcium are made soluble for each pound of nitrogen oxidized, aside from the action of the acid radicles associated with the ammonia. The ratio of solubility found on the basis of nitrogen to phosphorus and calcium conforms to the following reaction:



According to this equation, 56 pounds of nitrogen liberate in soluble form 62 pounds of phosphorus and 120 pounds of calcium.

Plants are important factors in the liberation of phosphorus, owing to the production of carbon dioxide and the removal of the soluble phosphorus produced by the bacteria.

Neither ammonia-producing bacteria nor nitrate bacteria liberate appreciable amounts of soluble phosphorus from insoluble phosphates. Other acid-producing bacteria make phosphorus soluble from insoluble phosphates according to the nature and amount of the acid produced.

A comparison of the amounts of nitrogen, phosphorus, and calcium required by farm crops with those possible of solution by biochemical action (see the appended table) shows possibilities far beyond the plant requirements; which leads to the conclusion that plenty of rock phosphate

in contact with decaying organic matter must give the plants an excellent opportunity to obtain both phosphorus and calcium as well as nitrogen.

*Phosphorus, Calcium and Nitrogen Required by Crops, Compared with that Possible of Solution When Nitrite Bacteria Act upon Tricalcium Phosphate.*

Crop	Nitrogen		Phosphorus		Calcium	
	lb. Required	lb. Required	lb. Possible	lb. Required	lb. Possible	lb. Required
<i>Maize</i>						
Grain, 100 bushels	—	—	—	—	—	—
Stover, 3 tons	—	—	—	—	—	—
Cobs, $\frac{1}{3}$ ton	150	23	160	22	321	—
<i>Wheat</i>						
Grain, 50 bushels	—	—	—	—	—	—
Straw, 2 $\frac{1}{2}$ tons	96	16	107	11	206	—
<i>Oats</i>						
Grain, 100 bushels	—	—	—	—	—	—
Straw, 2 $\frac{1}{2}$ tons	97	16	108	17	208	—
Timothy, 3 tons	76	9	84	20	163	—

733 - *Changes in the Nitrogen Content of Stored Soils.* -- ALDRICH, W. A. (Contribution from the Department of Soils, University of Missouri) in the *Journal of the American Society of Agronomy*, Vol. X, No. 2, pp. 83-88 + Bibliography of 7 Publications, Washington, February, 1918.

Determinations showed that wet or dry samples of soil stored in or near laboratory in containers not hermetically closed risk contamination from ammonia. Moreover, when wet soils are allowed to dry slowly bacterial action seems to affect the nitrogen content very little. The ammoniaeal nitrogen contained in the soil is held by a purely physical adsorption phenomenon, not by moisture.

734 - *Report on Irrigation Surveys and Inspections in Canada for 1916-17.* -- I. DRAKE, E. F. (Superintendent of Irrigation), Report of the Superintendent. -- II. PETERS, F. H. (Commissioner of Irrigation and Chief Engineer), Report on Irrigation and Canadian Irrigation Surveys, in *Department of the Interior of Canada*, pp. 79 + 8 Diagrams + 1 Plan + Bibliography of 11 Publications, Ottawa, 1917.

The report of the Irrigation Branch of Canada for the year ending March 31, 1917, includes 2 reports.

The first is by Mr. E. F. DRAKE, who deals briefly with the state of irrigation development, with hydrometric surveys (the territory covered by this work is divided into 13 districts, each in charge of an engineer, who, with one helper and the necessary gauge observers, performs all the field work); during the open water season, 177 gauging stations were maintained, records being taken at 138 gauges on irrigation canals and ditches; during

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the winter, 84 stations were maintained) and drainage (projects, subsidies and legal agreements).

The second report, by Mr. F. H. PETERS, deals with the organization of the staff, office work, hydrometric work and the study of irrigation projects 1) for land lying east of Macleod (using the Oldman river), of an area of 25 000 acres and at an estimated cost of \$ 228 000 ; 2) for the Taber district, Alberta (17 000 acres) ; 3) for the Lethbridge Northern District (area of 97 531 acres ; estimated cost \$ 2 274 316) ; 4) for land situated in the basins of the Milk and St Mary rivers (a project requiring a Treaty between the United States and Canada ; area of over 500 000 acres, for which 7 different irrigation schemes are described).

The inspection of the irrigable lands in the Eastern Section of the Canadian Pacific Railway Company's Irrigation Block, begun in 1913, was completed in 1916. About 130 240 acres were inspected. Experiment plot work was carried out at Strathmore and Ronalane (Alberta) on the amount of water required to obtain the highest yields of alfalfa, clover, wheat, oats, barley, peas, potatoes, maize, turnips, timothy, etc. Further information on the same subject was obtained at Coaldale, near Lethbridge, and crop reports were obtained for the Cypress Hills District, Saskatchewan, and for Calgary, Alberta.·

The results of the experiments are given in numerous tables.

735 - **The Colorado River and its Utilisation.** — I. LA RUE, E. C., in *U. S. Department of the Interior, Geological Survey, Water-Supply Paper*, No. 395, pp. 231 + 5 Figs. + 25 Plates. Washington, 1916. — II. GRUNSKY, C. E., in *U. S. Senate, 65th Congress, 1st Session, Document No. 108*, pp. 38. Washington, 1917.

I. — The U. S. Geological Survey was the first to study the hydrography of the Colorado basin by establishing gauging stations on the Gila River, at Buttes, Arizona, in 1889. Since then all the services (5) of the various federal government departments interested in the subject have collaborated in a study of the water-system of the Colorado or have studied it separately from different points of view. Mr. LA RUE has collected the many observations made so as to present a more complete consideration for the best methods of utilising the Colorado river, the course of which is 2200 miles.

After describing the physical conditions of the Colorado basin the author gives historical notes on the various explorations of the river from 1531 to 1911, and a hydrographical and geological bibliography of the basin. In his study on the system of the river and its tributaries the author gives in a series of tables the output of each of them according to observations made from the beginning. The present state of irrigation of the Colorado basin is described and a detailed examination made of the river and its tributaries, the possibility of increasing the area irrigated by building numerous weir reservoirs, the regulation of the water courses and construction of canals.

In 1913 the area irrigated by the river and its tributaries was 1 581 000 acres in the United States and 50 000 in Mexico, or 1 631 000 acres in all.

According to the author it would be possible to irrigate 4 002 000 acres in the United States and 807 000 acres in Mexico, or 4 899 000 acres in all.

The unused motive power is estimated at 2 666 910 H.P. At the present time 25 hydro-electric works develop 77 525 H.P. in the Colorado basin.

The author also studies the regulation of the river and its tributaries so as to avoid floods. He values at \$ 30 000 000 to \$ 50 000 000 the value of land subject to damage from floods in the Imperial Valley, and at \$ 10 000 000 to \$ 15 000 000 the land requiring protection between Bull's Head Rock and the frontier. The extent and frequency of the floods are also examined.

II. - Mr. C. E. GRUNSKY, whose study was presented to and published by the U. S. Senate, re-examines the possibility of developing irrigation in the Colorado basin.<sup>1</sup> He studies not only the old projects and the present concessions granted to irrigation companies, but thoroughly examines the international point of view and the collaboration between the United States and Mexico to solve the difficulties concerning the regulation of the Colorado river and the quantity of water to be delivered to Mexico by any diversion canal below Pilot Knob. All the questions touching on an agreement between the United States and Mexico on this subject are enumerated.

736 - *Schemes for Barrage-Reservoirs in Tunis*, -- CONNET, J., in *L'Hydraulique en Tunisie*, pp. 143, 2 Tables, 3 Diagrams, 2 Plans + 3 Maps. Tunis, 1917.

After considering the need for utilising the surface water in Tunis by making great barrage-reservoirs, the author quotes objections to the construction of works holding up the water of rivers that do not flow all the year round or of beds that are in flood a few times only each year. Besides the benefit to agriculture barrages would, with the systematization of the watercourses, furnish motive power for various industries as well as drinking water for towns and centres of colonization.

The author describes the chief dams he has studied, amongst which he mentions :-

1) The barrage-reservoir of Hammam Zriba destined to complete the drinking water supply of Tunis and neighbourhood as well as to provide drinking and irrigation water for the centres of colonisation situated downstream from the barrage. This reservoir to be constructed on the Oued El-Hamnam at the entry of the Zriba gorges will cover an area of 95 hectares and store 11 430 000 cu. metres of water. The reservoir will annually receive about 20 000 000 cu. metres. The height of the barrage will be about 100 ft.

2) The barrage-reservoir on the Oued Geroud which can hold 90000 cu. metres, giving a delivery of 12 500 litres per second. The height of the dam is about 143 ft.

The area that could be irrigated with 4000 cu. m. per hectare (cereals) would be about 100 000 hectares situated chiefly between Kairouan and Ennas. This dam would admit of developing a force of 5 000 H.P. Its construction would, however, encounter certain technical difficulties, chiefly

in the displacement of the railway. In fact, the project necessitates the submersion of the Rahrmate tunnel.

3) The systematization of the Medjerdah with the construction of 2 large barrage-reservoirs at Oued Tessa and Testour and the utilisation of the barrage-bridge of El-Bathan, which would allow of irrigating all the outskirts of Tunis and of 50 000 hectares between Testour and Grombalia. The statistics of the areas to be irrigated and the quantities of water required indicate only 27 000 hectares for the Medjerdah for the first few years, but as the Testour reservoir will provide 430 000 000 cu. m., the irrigation area can be afterwards increased by about 30 per cent.

The author gives interesting information regarding other projects of barrage-reservoirs to be constructed on the rivers Kassem, Mellegue, Bou Kebir, Koceine, Masri (O. Melah) and Chiba, and Sedjanne, the execution of which would allow of irrigating a large area.

In conclusion, the author insists upon the urgent need for immediately constructing barrage-reservoirs in Tunis so that the country can replace or procure at least a part of the indispensable products that are generally lacking.

737 — **Irrigated Farms in Utah, U. S. A.** — See No. 811 of this *Review*.

738 — **Cultural Methods in Apple Orchards in Indiana, U. S. A.** — See No. 768 of this *Review*.

739 — **The Decomposition of Green and Stable Manures in Soil.** — POTTER, R. S. and SNYDER, R. S. (Assistant Chief and Assistant in Soil Chemistry, Iowa State College Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 13, pp. 677-698 + 9 Figs. + Bibliography of 8 Publications, Washington, December 24, 1917.

This paper is a continuation of previous studies (1) the principal aim of which was to determine the rate of decomposition of original or added organic matter in soil by estimating the amount of carbon dioxide evolved from manured soils. The last experiments were made in two series — one with applications of calcium carbonate, the other with liming.

The principal results show that the organic matter in soil decomposes more rapidly in soil treated with calcium carbonate or lime than in untreated soil. The decomposition of the total organic matter of a soil treated with stable manure or green manure (clover or oats) is hastened by the addition of calcium carbonate or lime.

Stable manure seems to hasten slightly the decomposition of green manures accompanying it, and these two forms of manure help to preserve the lime in the soil. No appreciable difference was noted in the rapidity of decomposition of green manures when applied dry and as a fine powder or fresh and in large pieces.

740 — **Sulphuric Acid and Fertiliser Industries in the United Kingdom.** — I. *The Books of Trade Journal*, Vol. C, No. 1170, pp. 268-271, London, March 7, 1918. — II. *The Chemical Trade Journal and Chemical Engineer*, Vol. LXII, No. 1607, pp. 293-297, London, March 9, 1918. — III. *Mark Lane Express Agricultural Journal*, Vol. CXIX No. 4511, p. 258, London, March 11, 1918.

A Committee was appointed by the British Minister of Munitions in

(1) See R., 1917, No. 9. (Ed.).

February 1917, to consider and report on the position of the sulphuric acid and fertiliser trades as affected by the new acid plants which have been erected during the war by the Ministry of Munitions.

From the report just issued it appears that the production of sulphate of ammonia and of phosphatic manures before the war provided the principal outlets for sulphuric acid, these two industries absorbing about 60 % of the pre-war production.

In consequence of the progressive introduction of by-product coking the output of ammonia was steadily increasing, and at the outbreak of the war amounted to 400 000 tons per annum expressed as sulphate. About 15 % of this production was not marketed in the form of sulphate, but was converted into other ammonia products. The home consumption of sulphate of ammonia for agricultural purposes was only 60 000 tons per annum, and the remainder was mainly exported.

For some years before the war the manufacture of superphosphate in the United Kingdom was in a very unsettled condition owing to the rapidly increasing importations of foreign manufacture and the gradual decline in the export trade. The export of superphosphates had reached a maximum of 160 000 tons in 1911, but had afterwards declined to 63 000 tons in 1913. The cause of this decline is to be sought partly in the erection of superphosphate plant in countries which previously imported this fertiliser, and partly in the competition of continental countries which, with the aid of cheap by-product acid from zinc manufacture, and in some cases with specially favourable freight conditions, succeeded in displacing their less favourably situated British competitors.

The United Kingdom possesses no natural advantages for the manufacture of superphosphates, since both pyrites and phosphates have to be imported as raw materials. It is, therefore, natural that when the consumption of superphosphate in countries such as Spain and Portugal reaches a certain point, local manufacture is undertaken, and, with the advantage of proximity to the raw material, soon succeeds in overcoming the competition of imported superphosphate from less favourably situated countries.

The expansion in the production of ammonia during the war has been somewhat accelerated owing to its association with the by-product coking industry. The production of sulphate of ammonia has, however, suffered a temporary decline, owing to the diversion of large quantities of ammonia to the production of nitrate of ammonia. In view of the requirements of sulphuric acid for explosives manufacture, plants have been erected on a considerable scale for the conversion of crude ammonia into concentrated ammoniacal liquor. A substantial proportion of the requirements of ammonia for munitions purposes have thus been purchased in a form which requires no sulphuric acid for its manufacture. The total production of sulphate has thus been temporarily reduced from 350 000 tons to a little over 250 000 tons.

At the same time, there has been a large increase in the home consumption for agricultural purposes, owing to the substitution of this fertiliser

ser for nitrate of soda, the entire supply of which has been required for explosives manufacture. The export trade has nearly disappeared, the only exports now allowed being relatively small quantities to Allied countries and British Possessions.

The production of superphosphate has been greatly reduced during the war owing to the lack of sulphuric acid. The production of superphosphate in 1916 fell to about 500 000 tons, accompanied with about 800 000 tons in 1913. During the last few months, however, the paramount necessity of increasing the home-grown food supply has been realised, and steps have been taken to secure a large and immediate production of superphosphate. Renewal and extension of superphosphate plant is accordingly proceeding at the present time with a view to recovering the lost ground as speedily as possible.

After hearing the evidence and considering the figures which have been laid before them, the Committee concluded that by far the most important prospect of utilising the increased quantities of acid is in the manufacture of artificial fertilisers.

With regard to sulphate of ammonia, which before the war was largely an export trade, it is probable that the impetus which has been given to home consumption will continue to be felt. It must be remembered, however, that the probable increased home consumption will to a very large extent be provided by a reduction of the export of this fertiliser below the pre-war figures. The limiting factor is at present the amount of coal carbonised in connection with recovery plant, and the acid consumption for sulphate manufacture bears a direct relation to this quantity, and not to the home consumption. During the war, although every effort has been made to extend by-product coking plants, the increased production of ammonia has only been about 7 per cent. The coke-oven industry may be expected to absorb larger quantities of acid during the years following the war, but the increase can hardly be considered of much importance to the acid situation.

The manufacture of ammonia from atmospheric nitrogen by the cyanamide process and by the Haber process may ultimately assume importance in the United Kingdom, but as the success of these processes is conditional upon the provision of cheap power, and as the processes are as yet undeveloped they cannot be so important a factor as to influence to any marked extent the conditions immediately following upon the cessation of hostilities. On the other hand, the introduction of synthetic methods for the production of nitric acid, which are low in early stages of operation, tends to diminish the consumption of sulphuric acid for the manufacture of nitric acid.

The Committee have found that the immediate increase in the consumption of acid after the war is almost wholly a question of the development of the superphosphate industry. They have accordingly considered evidence both from agricultural experts and from fertiliser manufacturers as to the probable post-war position. It is evident from the opinion of these witnesses, quite apart from any question of manufacturing facilities, that the greatly extended use of phosphatic manures is both economically profitable

and essential for the efficient cultivation of the land. The extent to which such extended use will in fact take place depends mainly upon the agricultural policy of the Government. Prof. T. H. MIDDLETON, Deputy Director General of the Food Production Department, submitted to the Committee an estimate of the post-war increase of fertilisers based on the assumption that 3 600 000 acres of arable land would be added to the existing area in the United Kingdom and that a larger proportion of the grass land would be manured. This estimate further indicated that an additional quantity of 620 000 tons of superphosphate and 629 000 tons of basic slag could with advantage be used. This increased quantity of superphosphate would correspond to the absorption of 200 000 tons of sulphuric acid.

The available supply of basic slag is not likely to approach the figure mentioned above, but as this phosphatic manure can to a considerable extent be replaced by superphosphate, it is evident that a much larger quantity of superphosphate could be employed if it were available.

It has been difficult to obtain any exact data regarding the question of the future export market for superphosphate. The export trade has declined, and fertiliser manufacturers themselves do not appear to anticipate any considerable revival. It would, therefore, be unwise to count upon the export trade as a means of permanently reducing the surplus of sulphuric acid to any extent, although in the years immediately succeeding the war Belgium may be a large buyer.

In view of the proved agricultural need for greater quantities of fertilisers, the Committee are of opinion that the large surplus of sulphuric acid plant which will become available at the end of the war provides an opportunity of an altogether exceptional nature for the development of a vigorous agricultural policy in relation to the efficient cultivation of the soil. Having regard, therefore, for the guarantees which are given to the farmer under the Corn Production Act, the Committee recommend that the powers provided by Section 9 of the Act should be widely used to enforce the adequate use of fertilisers.

In conclusion, the following recommendations are made for providing an outlet for the surplus sulphuric acid which may be expected over the pre-war production as regards the production of fertilisers:—

a) That in the exercise of any compulsory powers given by the Corn Production Act every possible step should be taken to extend the use of fertilisers.

b) That in every way — by lectures, by practical demonstrations, and by experiments carried out at Government expense on plots easily accessible in various parts of the country — farmers should be encouraged and educated in the increased use of fertilisers.

c) That arrangements should be made with shipping, railway, and canal companies for cheap and adequate transport of raw materials, acid, and fertilisers, and that cheap freights should be arranged for the carriage of fertilisers to any part of the Empire or any Allied or neutral country where an opening for a market may offer.

741 - Some Availability Studies with Ammonium Phosphate and its Chemical and Biological Effects upon the Soil (1). — ALLISON, F. E., in *Soil Science*, Vol. V, No. 1, pp. 1-79 + 10 Figs. + Bibliography of 36 publications. Baltimore, January, 1918.

The investigations were carried out with "Ammo-Phos", an ammonium phosphate fertiliser prepared by the American Cyanamide Company. It consists of ground mineral phosphate mixed with sufficient sulphuric acid to free all the phosphoric acid, which is removed by filtration and washing. Gaseous ammonia is produced by steaming crude calcium cyanamide in an autoclave under a pressure of several atmospheres; the ammonia is bubbled into the phosphoric acid until it is converted chiefly into di-ammonium phosphate, though at the same time some citrate-insoluble iron and aluminium ammonium phosphates are formed. Phosphoric acid is then added, using methyl orange as an indicator, till the proportion of mono-ammonium phosphate is attained which will make the insoluble phosphates assimilable. When evaporated to dryness the solution gives a commercial product, "Ammo-Phos", a light grey material resembling superphosphate.

Up to the present nearly all the investigations on the use of ammonium salts as fertilisers have been made with ammonium sulphate or other salts, but never with ammonium phosphate on account of its high price. Now that a satisfactory method has been found for producing it commercially it is important to determine the conditions under which this fertiliser gives the best results and the quantities in which it may be applied safely and economically to various crops.

According to the author's tests commercial ammonium phosphate fertiliser contains about 13.5% ammonia and 43% phosphoric acid, 96.5% of which is soluble in water and citrate. The nitrification of ammonium phosphate is similar to that of ammonium sulphate, but the ammonification differs. Soil fungi utilise the various nitrogenous compounds tested in the following decreasing order: -- ammonium phosphate, ammonium carbonate, ammonium sulphate, urea, ammonium nitrate, sodium nitrate.

On an average the nitrogen recovered from a sandy soil after six harvests (one of barley, four of buckwheat and one of maize) was: 65.88% for ammonium phosphate, 61.10% for ammonium sulphate, 43.74% for dried blood, and 41.19% for cottonseed meal. In a loam soil the recovery was respectively: -- 48.46%, 50.42%, 42.51%, and 36.49%. Liming increased the nitrogen recovery and the crop yield was in relation to this ratio except under very acid conditions, when ammonium sulphate gave a higher nitrogen recovery than phosphate, but a much smaller crop. The author believes the relatively low nitrogen recovery is due to the loss of free nitrogen or ammonia through the soil as well as through the plants. The increased lime requirement per acre resulting from the respective applications was: -- for ammonium sulphate 794 lb., ammonium phosphate 525 lb., dried blood 263 lb., and cottonseed meal 113 lb.

Pot experiments showed an almost equal utilisation of nitrogen for commercial ammonium phosphate, its aqueous extract and sodium nitrate.

(1) See R., 1916, No. 272 (Ed.)

Only the water insoluble ammonium phosphate gave a slightly lower yield than the other forms of nitrogen. Greenhouse experiments did not, on an average, show great differences in the availability of the phosphorus of the ammonium phosphate, superphosphate or basic slag. In very acid soils superphosphate was sometimes superior to ammonium phosphate as a source of phosphorus because it does not appreciably increase the acidity which ammonium phosphate does increase.

Germination experiments showed that, with equal quantities of nitrogen, ammonium phosphate has a toxicity equal to that of ammonium sulphate, but inferior to that of sodium nitrate and ammonium chloride, when applied in high concentrations. In very sandy soils toxicity is obtained with  $\frac{1}{10}$  the amount of fertiliser required in clay or silt soils. The toxic action of commercial ammonium phosphate does not exceed that of pure mono-ammonium phosphate. As regards the action of the various nitrogenous and phosphoric fertilisers on germination, liming decreased the growth of maize when the fertiliser was applied in small quantities, and increased the growth when large quantities of fertiliser were used. As a rule mixing fertilisers did not lessen the toxic effect. Maize, buckwheat, barley, wheat and oats resist heavy applications of fertiliser, but vetch, rape, and cowpea are relatively susceptible.

Under laboratory conditions the effect of fertilisers applied to 200 gm. of soil in glasses, was the same whether they were uniformly mixed with the soil or placed in direct contact with the seed. Under field conditions applications of 100 lb. of ammonium phosphate per acre in rows did not harm maize, but applications of 150 lb. proved slightly injurious.

In conclusion it may be said that ammonium phosphate has as a rule the same nitrogen value as ammonium sulphate and the same phosphorus value as superphosphate, and might be used to replace these two fertilisers. The few exceptions, under abnormal conditions, do not alter this conclusion, all the more so because ammonium phosphate is rapidly nitrified and utilised by micro-organisms and plants. The fertiliser resembles ammonium sulphate in its toxic effects when applied in high concentrations, and is slightly less toxic than sodium nitrate. As with other soluble fertilisers care must be exercised in the amount used when it is applied in drills.

712 - **The Identification of Grasses by their Vegetative Characters.** — CARRIER, LYMAN. (Agronomist in Pasture Investigations), in *U. S. Department of Agriculture, Bulletin No. 461*, pp. 39 + 60 Figs. Washington, January 19, 1917.

An attempt is made to identify grasses by the vegetative characters of their structure and of some special organs of the root, stem, and leaf, so that the inflorescence is not required for this purpose. Many attempts have been made previously to do this, especially by McALPINE, WARD, STEBLER and SCHRÖTER, and PERCIVAL. The author follows in part Percival's method, and gives a dichotomous table of 56 species which are classified and illustrated in the bulletin.

743 - **Composition of Citrus Leaves at Various Stages of Mottling (1).**—JENSEN, C. A. (Assistant in Plant Malnutrition, Office of Biophysical Investigations, Bureau of Plant Industry, U. S. Dept. of Agric.), in the *Journal of Agricultural Research*, Vol. IX, No. 6, pp. 157-166. Bibliography of 11 Publications. Washington, D. C., May 7, 1917.

Previous studies of the soil factors influencing the mottling of Citrus leaves in southern California have shown that the percentage of mottling of the Citrus leaves varies inversely with the humus content of soils in Citrus groves; that decomposing organic matter increases the amounts of soluble salts in the soil; and that a system of basin mulching in Citrus groves, especially on certain soil types, has produced an improvement in tree growth and fruit setting in comparison with the furrow system of irrigation and surface cultivation.

The purpose of the study here reported was to see if mottled Citrus leaves showed a deficiency of the mineral elements directly affecting chlorophyll formation.

It was found that very badly mottled orange and lemon leaves contained higher percentages of iron, calcium, magnesium, and phosphoric acid than healthy leaves, the average percentage of the entire leaf being considered. The leaves in the medium stages of mottling sometimes contained more and sometimes less of these elements than healthy leaves.

In nearly all cases the midribs of the healthy leaves contained less of the above mentioned elements than the mesophyll tissue. In badly mottled leaves the midribs contained a higher percentage of calcium than the mesophyll tissue, usually as much magnesium, and usually more phosphoric acid.

With very few minor exceptions, the leaf stems contained less iron, calcium, and magnesium than either the midrib or mesophyll area in both healthy and mottled leaves. The percentages of calcium, magnesium, and phosphoric acid, however, increased in the leaf stems of badly mottled Citrus leaves, but usually not in the medium mottled leaves.

Old leaves contained higher percentages of calcium and magnesium than new leaves not fully grown.

In all the Citrus leaves analyzed, the phosphoric acid was quite uniformly distributed in the midribs, the mesophyll tissue and the leaf stems (regardless of age or stage of mottling), indicating that phosphoric acid is early and freely transferred through the conducting tissue to the mesophyll areas. Sharply outlined yellow spots in the mesophyll areas of orange leaves contained less calcium, magnesium, and phosphoric acid than the green parts (mostly veins) of the leaves.

Judged by a comparison of the average percentages of the inorganic elements determined in healthy Citrus leaves and in leaves in the medium stages of mottling, the data obtained did not show that the initial mottling could be accounted for by deficiency in the transfer of the iron, calcium, magnesium, and phosphoric acid from the conducting system of the leaf stem and midrib to the mesophyll tissue. On the other hand, sharply localized yellow areas in old orange leaves contained less of these elements than the

(1) See also *R* February 1918, No. 173. (*Ed.*)

adjoining green areas (mostly veins), but whether that relation obtained in the initial stage of mottling was not determined. In very badly mottled Citrus leaves there was in general an increase in the percentage of these elements in the conducting tissues, including the leaf stems, indicating difficulty in their transfer to the mesophyll tissues in very advanced stages of mottling, probably because the leaf had become functionless.

Green leaves and the green parts of spotted leaves of the golden privet (*Ligustrum aureum*) contained about twice as much calcium and appreciably more magnesium than the yellow leaves. Yellow leaves and the yellow parts of spotted leaves contained more iron than and about 2.5 times as much phosphoric acid as the green leaves or green parts of spotted leaves. Leaf stems of green privet leaves contained lower percentages of iron, calcium, magnesium, and phosphoric acid than the leaves. Leaf stems of yellow privet leaves contained about one-half as much phosphoric acid as the leaves; the percentages of iron and magnesium were about the same, while the leaf stems contained more calcium than the leaves. The leaf stems of yellow privet leaves contained higher percentages of calcium and magnesium than the leaf stems of green privet leaves.

744 - **The Fats and Fatty Acids of the Grain Sorghums.** — FRANCIS, C. K. and FRIEDEMANN, W. G., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Stillwater, Oklahoma, Bulletin No. 117*, 11 pp., 1 Fig., 5 Tables. Stillwater, Okla., October, 1917.

Six fatty acids have been shown to be present in kafir, feterita and milo fat; namely: oleic and linoleic, stearic and palmitic, butyric and formic, predominating in the order given. Traces of saturated acids higher than stearic acid are present in kafir and milo fat. The tables given by the authors show that the physical and chemical constants of the fats and fatty acids of kafir, feterita and milo are similar. The percentages of fat obtained by the extraction method were as follows: feterita 2.72-2.80; milo 2.53-2.61; kafir 0.89.

745 - **The Chymase of *Solanum elaeagnifolium*.** — RODANSKY, A. (Department of Physiology and Biochemistry, Cornell University, Ithaca), in *The Journal of Biological Chemistry*, Vol. XXVII, No. 1, pp. 103-105. Baltimore, Md., 1916.

In New Mexico and Arizona the berries of *Solanum elaeagnifolium* are used as a substitute for rennet in the coagulation of milk. By means of maceration and precipitation with acetone the writer has extracted from the mature berries a chymase which possess the following properties:— It coagulates boiled natural milk without addition of calcium chloride. It proved more resistant to heat than animal rennin. In tests conducted between 37 and 55° C. the time of coagulation was inversely proportional to the quantity of the enzyme, other conditions being constant. Increase of temperature had the effect of increasing the rapidity of coagulation, but it also inactivated the enzyme. The optimum temperature was 84° C., in a dilution of one part of the solid enzyme preparation to 20 000 parts of milk, coagulation taking place in about 1 minute. In a dilution of 1:100 000 coagulation occurred in 10 minutes the enzyme being obviously inactivated.

ed in the higher dilution by the longer exposure to heat. Preliminary tests failed to discover any pronounced peptic or tryptic action of the extract.

716 - **New Observations on the Degradation of Inulin and "Inulids" in Chicory Roots.**—CESIAN, B. and WOLFF, J., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 10, pp. 428-430. Paris, March, 11, 1918.

In a previous paper (1) the authors showed that under the influence of diastases the inulin of chicory roots is gradually degraded to a hexose form, passing through the intermediate non-reducing but fermentable forms which they have called "inulids".

The authors have followed the degradation of the inulids in the root during its preservation by the use of two yeasts differing greatly in their action on these compounds:—1) *Schizosaccharomyces Pombe*, which has no action on inulin, but attacks all the inulids derived from it; 2) a Burgundy yeast which attacks only the least condensed inulids and the products of their hydrolysis. The juice of roots harvested in October and December and the juice of the same roots after they had been stored for a month were fermented comparatively with these two yeasts.

The inulids may thus be divided into two groups according to their fermentation characters and their successive degradations be observed according to the yeast used—P or R.

*Results obtained with roots harvested in October the juice of which was examined immediately (I) and again a month later (II): results based on 100 of carbohydrates.*

	I	II	Difference
Matter fermented by yeast B.	33.5	58.8	25.3
P . . . . .	50.0	75.0	25.0
Difference (P inulids) . . . . .	17.4	26.1	2.7

It is seen that during the month's storage the amount of B inulids increased by 25.3. It is probable that these B inulids were derived from the P inulids; as these increased by 2.7 and could only be derived from the inulin, more P inulids formed than disappeared. This result may vary with the date of the harvest, for the authors noticed that in the December roots kept for a month less P inulids were formed than disappeared.

To sum up, for October roots, 100 gm. of total carbohydrates give:

	Juice	
	at the beginning	after 1 month
Unfermentable inulin . . . . .	44.2	21.4
Inulids fermented by Pombe only . . . . .	17.4	20.1
Transformed P inulids fermented by B . . . . .	—	22.3
Initial inulids fermented by B . . . . .	33.5	33.5
Undetermined matter . . . . .	4.9	2.7
	100.0	100.0

(1) See *R.*, Dec., 1917, No. 1137. — For inulin in plants see also *R.* April, 1918 No. 399. (*Ed.*)

The same experiments and calculations for December roots gave :—

	Juice	
	at the beginning	after 1 month
Unfermentable inulin . . . . .	31.4	20.3
Inulids fermented by P. only . . . . .	17.5	15.2
Transformed P inulids fermented by B . . . . .	—	11.8
Initial inulids fermented by B . . . . .	52.3	52.3
	181.2	99.6

747 — **The Relation of Amide Nitrogen to the Nitrogen Metabolism of the Pea Plant.** —

SURE, BARNETT and TOTTINGHAM, W. E. (Department of Agricultural Chemistry, University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXVI No. 2, pp. 535-548, 3 Diagr. Baltimore, Md., September, 1916.

In studies of nitrogen metabolism in plants, one of the most striking observations has been that asparagine accumulates to a considerable extent in shoots of growing seedlings, especially when germinated in the dark for 2 to 3 weeks, but disappears during later growth.

This observation has been the subject of much discussion. Different theories have been proposed to explain the physiological rôle of asparagine and the chemical processes involved in its accumulation in plant metabolism, but the problem has not yet been definitely solved.

The purpose of the present investigation was to determine whether, during germination, there is a direct relation between the disappearance of amino-acids and the accumulation of amides, as determined by methods more strictly quantitative than those formerly used.

About 400 gm. of air dried peas were soaked for about 12 hours in distilled water and planted in sand in a greenhouse. The sand was watered with distilled water daily. The seedlings were partially etiolated for the purpose of stimulating the accumulation of amides by retarding photosynthesis. A first crop was harvested after 5 days of growth, a second after 13, another after 19, and the last after 26 days.

The main observations may be summarized as follows :—

After 26 days the total nitrogen more than doubled in percentage in the shoot. This was possible only when carbohydrate decomposition was more rapid than protein disintegration, and indicates that during the early stages of growth of the etiolated pea plant, the shoot is the seat of rapid carbohydrate catabolism.

The total nitrogen somewhat decreased in the cotyledon and, during earlier stages of growth,  $\alpha$ -amino-acids accumulated in the cotyledon even to greater extent than in the shoot. This indicates that catabolism is the predominant type of change in protein material of the cotyledon during germination.

The water-soluble nitrogen maintained a rather constant proportion of the total nitrogen throughout the period of growth investigated with the exception of the first stage, when it accumulated to a considerable extent.

Ammonia was present only in traces in the seed, but accumulated as

germination advanced. It fluctuated in the cotyledon somewhat parallel to amide nitrogen, but in the shoot it decreased while amide nitrogen increased.

Amides accumulated in the shoot throughout all the different stages of germination, but not in such large proportions as previous investigators have reported. This may be due to the faulty methods of analysis formerly employed. In the cotyledon the amide nitrogen fluctuated somewhat at early stages, but later increased remarkably, while  $\alpha$ -amino-acids were disappearing rapidly.

Amides accumulated while carbohydrates and ammonia decreased. It may be inferred that they were produced synthetically from the latter compounds. The evidence for such a view from this study, however, is insufficient to be conclusive.

$\alpha$ -amino-acids accumulated rapidly, especially in the cotyledon during the earlier stages of growth. In the later stages of growth they decreased considerably in the shoot and disappeared rapidly and completely from the cotyledon.

The accumulation of amides simultaneously with the decrease of  $\alpha$ -amino-acids and ammonia in the shoot indicates that  $\alpha$ -amino-acids serve for amide production in the nitrogen metabolism of the etiolated pea plant.

748 - **The Effect of One Plant on Another.** — PICKLING, SPENCER, in *Annals of Botany*, Vol. XXXI No. 122, pp. 181-187 + 3 Figs. London, April, 1917.

As a result of numerous investigations started in 1895 the author noted the injurious effect which one plant may have on another. In a series of pot experiments he found the following species to be subject to such influence: — apple, pear, cherry, plum, six kinds of forest trees, mustard, tobacco, tomatoes, barley, clover and two varieties of grasses. The plants exercising the injurious effect were apple seedlings, mustard, tobacco, tomato, two varieties of clover and sixteen varieties of grasses.

Some plants can exercise this action on other individuals of their own species; this is the case with tobacco, tomato, mustard and apple. This may be compared with the well-known phenomenon of the bad development of a young plant near an older one. The author believes that the roots of the plant exercising the injurious influence secrete a toxic substance. Recent experiments confirmed this theory. He made three pot experiments with mustard. On the surface of the first pot was placed a tray containing soil, and so perforated that the water percolated through to the pot below. In this case growth was normal and there was no injurious effect. In the second test a crop of mustard was grown in the tray, but the holes were stopped and the water for the plants in the pot below was given to them direct. Growth was also normal in this case. The conditions in the third test were similar to those of the second, except that the holes were left open and the water for the plants below only reached them after having passed through the tray. In this test the growth of the mustard in the large pot was reduced to  $1/100$  of the normal growth.

The extent of this action varies greatly ; in pot experiments reduction in growth varies from 6 to 97 % ; in field experiments with trees it may be very small or sufficient to kill the plant.

Attempts have been made to explain this phenomenon by many hypotheses, such as rapid exhaustion of the soil, etc., but they have all been rejected. The toxic substance which appears to cause the action oxidises rapidly ; water containing it loses its toxic properties when exposed to the air for 24 hours.

749 - Selection of Wheat in Ontario, Canada. — ZAVINZ, C. A., in the *Ontario Department of Agriculture, Agricultural College, Bulletin 261*, pp. 39 + 1 Figs. Toronto (Ontario), February, 1918.

WINTER WHEAT. — 1) The mass selection method is still followed by the Canadian Seed Growers' Association and by some experiment stations. Seed obtained in the third year after three successive selections is sold as a guaranteed selected product.

2) An excellent example of the results of individual selection is shown by the winter wheat Dawson's Golden Chaff derived from a plant isolated in 1881 near Paris, Ontario. This plant, remarkable in the midst of lodged wheat on account of the strength and elasticity of its straw, which prevented its lodging, transmitted its character to its descendants, which now form one of the favourite wheat varieties. By individual selection of the variety Imperial Amber a pure line was obtained with a yield exceeding that of the parent variety by 3.9 bushels per acre.

3) The hybrids Dawson's  $\times$  Tasmania Red, Dawson's  $\times$  Bulgarian and Dawson's  $\times$  Turkey Red gave in all cases an average grain yield superior to that of the parent plants.

The cross Dawson's  $\times$  Bulgarian gave a new variety, O. A. C. No. 104, which, during 6 years, gave an average of 45.0 bushels per acre, i. e., 4.2 bushels more than Dawson's and 7.5 bushels more than Bulgarian. Not only did O. A. C. exceed the yield of both its parent plants, but it also exceeded the other varieties more widely grown in Ontario — Imperial Amber, Kharkov and Yaroslaf. The new variety is beardless, like Dawson's and has white glumes, like Bulgarian.

In addition to these selection experiments numerous tests were made on yield, resistance to rust and lodging, with the following results : —

The average grain yields for 5 years were : — Imperial Amber, 45.8 bushels per acre ; Kharkov, 45.7 bushels ; Gillespie Red, 45.2 bushels ; McBean's Golden Chaff, 45.1 bushels ; Tuscan Island, 43.9 bushels ; Grand Prize, 44.7 bushels ; American Banner, 44.6 bushels. These are the varieties best suited to the district. Theiss, Kharkov, Tuscan Island, Yaroslaf and Banatka were free from rust ; Tystoite Smaa and McBean's Golden Chaff were both badly attacked. Dawson's Golden Chaff, American Banner, Imperial Amber, Michigan Amber, McPherson and Scott were the earliest varieties. The varieties with the weakest straw and, consequently, most subject to lodging, were Banatka, Theiss, Crimean Red, Geneva and Kharkov.

SPRING WHEAT. — 1) A new hybrid obtained by crossing the Red Fife

and Herison Bearded varieties gave, on a five year average, a yield (40.7 bushels per acre) superior to any of the spring varieties tested in Ontario.

The results are given of numerous selection experiments with spring and winter wheat and rye, all of which confirm the influence of selection of the largest and heaviest seed on the crop.

750 - **Increased Self-Fertilisation of Petkuser Rye by Pure Line Selection, in the Netherlands.** — MEYER, GMELIN H., in *Cultura*, Year XXX, No. 353, pp. 14-19. Wageningen, 1918.

In 1915 the author sorted out 50 ears of Petkuser rye in order to determine whether distinct and improved types could be isolated by pure line selection. The results are of special interest with regard to the self-fertilisation of rye (1).

In 1916 the plants of each strain were divided into three groups:— 1) plants freely exposed to cross-pollination; 2) plants the inflorescences of which were partially isolated with muslin, the web being coarse enough to let pass a certain amount of pollen carried by the wind; 3) plants the inflorescences of which were completely isolated with parchment.

In 1917 the ears of a certain number of descendants of each of these three groups were completely isolated before flowering by bags of parchment. The plants thus subjected to forced self-fertilisation showed marked differences in the percentage of setting. Some, as those of line 3, had as much as 57 seeds per ear, whereas others did not produce as much as a single seed. Line 3 was remarkable for its high degree of self-fertilisation, with an average of about 20 seeds per ear. It is, therefore, possible by pure line selection to isolate types of rye with a degree of self-fertility much above the normal.

The author intends to continue this selection work taking into consideration the shape and colour of the ear. The original number of strains has been gradually reduced to three — Nos. 28, 37 and 3 — by successive elimination of the worthless ones. Line 28 has an ear with square section of the real Petkuser type. Line 37 is characterised by a special colour of the unripe ear and by a tendency to produce three seeds per spikelet, which makes it very broad and compact. As has been already said, line 3 ranks first in self-fertilisation.

751 - **Selection Experiments with Two Cultivated Oats According to the Position of the Seed in the Spikelet, in France.** — DANILLE, L., and MUGR, E., in *Annales des sciences naturelles*, Vol. XX, Nos. 1-6, pp. 289-308. 11 Tables and 6 Figs. Paris, 1917.

The spikelets of oats are composed of a variable number of alternate flowers which may be arranged as follows:—

- 1) Two fertile flowers, internal and external, and a much larger and more membranous sterile flower;
- 2) Three fertile flowers, one of which, known as "intermediary", is between the external and internal flowers;

(1) The degree of self-fertilisation of rye is very low; the percentage of setting in self-fertilised plants rarely exceeds 5 %. See *R. Feb.*, 1918, No. 146, (Ed.).

3) A single fertile flower called "single" flower, and one rudimentary sterile flower; the former represents the external flower of the preceding cases.

Four very different kinds of seed correspond to the various flowers:—*a)* external; *b)* single; *c)* intermediary; *d)* internal. The size, morphological peculiarities and proportion of these seeds serve to differentiate the principal varieties of cultivated oats. It is generally admitted that the external seeds are heavier than the internal ones, but the kernel is not so plump. As regards weight and construction single seeds closely resemble external seeds, intermediary seeds internal ones.

This has been shown by the work of various authors (chiefly DENAIFRE & SIRODOT, DUFOUR), but up to the present no investigation appears to have been made into the agricultural value of these different seeds and the possibility of a selection based on their separation, and the advantages to be derived therefrom. Nevertheless, the very position of these different seeds on the inflorescence and their respective development seems to show that there exists between them, in addition to their morphological differences, physiological differences capable of being transmitted to their descendants.

In order to solve this question the authors undertook from 1910 to 1913 a set of experiments the results of which they now give.

In the first place, from a commercial lot of the two varieties, Canadian white oats and Brie black oats, 1,000 seeds were chosen at random, and divided into the four above mentioned groups to determine the proportion. A predominance of intermediary seeds was found in the white oats, and of external ones in the black oats.

An equal number (300) of the seeds of each group and the original mixture was sown in separate plots in order to determine the yield and characters of the descendants. The yields of the four groups (I-IV) and the original mixture (V) were:—

*White oats.* — I) 245 gm.; II) 165 gm.; III) 175 gm.; IV) 215 gm.; V) 210 gm.

*Black oats.* — I) 135 gm.; II) 250 gm.; III) 160 gm.; IV) 130 gm.; V) 180 gm.

In white oats, therefore, the external seed gave the highest yields, in black oats the single seeds. This shows that the position of the seed on the spikelet does not influence the yield.

It was of interest to know whether the descendants of the external seeds of white oats and the single seeds of black oats were respectively richer in external seeds and single seeds, and, consequently more productive than the parent variety. To test this the descendants of each of the above groups of seed were sorted in 1911 with the following results: in white oats the single seed predominated in the descendants of each group, being most numerous in those of the *internal* seeds. In black oats, on the contrary, the *external* seeds predominated, reaching their maximum in the descendants of the *intermediary* seeds. Thus, in spite of selection, the same type of seed (single in white oats, external in black oats) was

predominant in all the groups. Moreover, selection did not accentuate or even preserve, the character which it should have perpetuated, for the number of seeds in each category was about the same from whatever kind of seed it was derived.

The inefficiency of the selection was also clear when the composition of the descendants of the sorted and mixed seeds was compared. The differences were very small, practically negligible, and all the seed, whether sorted or not, may be said to have given the same result.

Determinations were also made for each group of the weight of 100 seeds and the relative proportion, in weights, of the coat and kernel. It was found that these factors depend neither on heredity nor selection, but vary according to the varieties and environmental conditions (climate, etc.).

**CONCLUSIONS.** — 1) The proportion of the different seeds, as characterised by their position on the spikelet, is not hereditary but subject to environmental conditions the influence of which is manifest in a different way according to the variety under consideration.

2) The weight of the different seeds is very variable.  
3) Selection based on the separation of these different seeds is of slight value as regards their distribution among the descendants, their weight, or the relative proportion of coat and kernel.

4) The different seeds are of unequal value as regards yield and the quality of the product, but these values are not characteristic of the seed and vary with the variety and climatic conditions.

5) The 1913 experiments gave results differing slightly from those of the preceding years; they showed the actual and general predominance of two-seeded spikelets, but this predominance, present in all the groups whatever their origin, cannot be attributed to selection.

6) Finally, if the position of oat seeds on the spikelet gives them certain morphological peculiarities (known for a long time and enabling them to be easily distinguished), it gives them no physiological property or special hereditary quality so that it does not make efficient selection possible.

752 — **The Inheritance of Characters in Rice, in India.** — PARNELL, F. R., RANGASWAMI AYYANGAR, G. N., and RAMAII, K., in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. IX, No. 2, pp. 75-105 + 21 Tables + 5 Coloured Plates. Calcutta, November, 1917.

The experiments described were started at the Government Farm of Coimbatore in 1913 with about 100 varieties of rice.

**SIZE OF OUTER GLUMES.** — The rice spikelet is single-flowered, with two outer sterile glumes, 1 inner fertile glume, and a palea; these two last are joined and referred to together as inner glumes. The outer glumes are small, rarely more than  $\frac{1}{4}$  to  $\frac{1}{3}$  the length of the inner glumes, except in the Rakki Pakshi Bhatta variety, in which both kinds of glume are about the same length.

In a plot of rice with short outer glumes which had been exposed to cross-fertilisation, were found several varieties with long outer glumes. Eight of these were selected and all their descendants were long glumed. On the other hand some of the short-glumed varieties transmitted this

character without change, whereas others had mixed descendants including short-glumed and long-glumed plants in the Mendelian ratio of 3:1, thus showing the short-glumed character to be dominant to the long-glumed.

**GOLDEN COLOUR OF INNER GLUMES AND INTERNODES.** — The colour is usually light green, but in many cases it is gold, and when such this character is recessive to green, the ratio of green-glumed to gold-glumed plants in  $F_2$  being 3:1. In other cases transmission of colour is so complicated as to suggest the presence either of another determinant for the gold which is incompletely dominant to green, or of an inhibitory factor acting only on the glumes, the internodes remaining golden.

**FACTOR CONCERNED IN THE DISTRIBUTION OF COLOUR IN THE GLUMES.**

— The inner glumes are often of a characteristic blackish-brown colour which affects the furrows more particularly. As the golden colour, the blackish-brown may be subjected to a factor which localises it in the centre of the glume, the top and base of which remain entirely green. This factor is dominant; in  $F_2$  the respective numbers of plants with piebald glumes and those with glumes of uniform gold or with blackish-brown furrows down their whole length, are in the Mendelian ratio of 3:1.

**PURPLE PIGMENTATION.** — This is due to the presence of anthocyanin in the cell sap. The character "pigmented" is dominant to the character "unpigmented". Between the pigmented and unpigmented individuals there are the two ratios 3:1 and 9:7, which suggests the presence of two distinct factors of pigmentation. This hypothesis was confirmed by the results of an experiment in which purple pigmented plants were obtained from a cross between the unpigmented Garudan Samba variety with an  $F_3$  hybrid, also unpigmented. The two purple factors were evidently distributed in a heterozygous state in the two parents.

**DARK PURPLE COLOURING OF THE PULVINUS AND AURICLE.** — In the absence of the factor causing this colour the *pulvinus* (swollen zone at the base of the leaf-sheath immediately above the node) and the auricle remain green or greenish-white. In this case the pigmented character is also dominant.

Similar conditions also govern the purple pigmentation of the leaf-sheath; this pigmentation often extends to the ligule.

**PURPLE LINING OF INTERNODE (L), PURPLE GLUMES (G), PURPLE STIGMA (S), PURPLE AXIL (A).** — To study these characters, the determinants of which are expressed by the letters in parenthesis, a cross was made between two plants of the Basangi variety, one of which had purple lining of the internode, purple glumes and no pigmentation of the stigma or axil (LGGSSAA), the other purple stigma and axil but no pigment in the other organs (LggSSAA).  $F_1$  gave a hybrid with the formula LggSsAa.

In  $F_1$  it was found that each character, considered separately, is dominant to the character "unpigmented". Considered together, however, these characters showed that: — 1) purple lining is associated with purple glumes (L and G in conjunction); 2) purple stigma is associated with purple axil (S and A in conjunction); 3) green internodes and glumes are associated with purple stigma and axil. In  $F_2$  there are, then, only three

distinct types:— **Lgsa**, **LGSA**, **lgSA**, present in the ratio 1 : 2 : 1; thus **L** is coupled with **G**, **S** with **A** and **LG** repels **SA**.

The  $F_1$  hybrid with the formula **LlGgSsAa** thus only forms two types of gamete: **Lgsa** and **lgSA** which combine in  $F_2$  to form 1 **LLGgssaa**, 2 **LlGgSsAa**, 1 **llggSSAA**, *i. e.*, two pure types resembling the parents and 1 type resembling the  $F_1$  hybrid.

The two factors **S** and **A** are constantly coupled and the authors never found any exception to this rule. **L** and **G**, however, sometimes show aberrant types thus proving the connection between them to be less strong than that between **S** and **A**. Cases of repulsion were observed not only between the two groups **LG** and **SA**, but also between **LG** and **S**, **G** and **S**, **L** and **S**.

**RIPENING BLACK CHARACTER OF INNER GLUMES.** — In certain varieties of rice, when the grain begins to ripen the glumes turn almost entirely black, becoming paler later so that, when ripe, they are of a dull smoky colour. The black character is dominant to the straw-coloured character and evidently depends on two factors. This was shown by an examination of  $F_2$ , in which the number of plants with black glumes and yellow glumes respectively were in the ratio of 3 : 1 or 9 : 7, according to whether the parent is heterozygous for one or both of these factors.

**COLOUR OF THE GRAIN.** — The colour of husked rice varies, from white through a series of intermediate shades, to red.

By crossing the Sadai Samba (white) and Boru Muruthagna Bhatta (red) varieties, were obtained, in  $F_2$ , red-grained and white-grained individuals in the ratio of 3 : 1. Red therefore is dominant to white.

In certain cases, however, the segregation of these characters is more complicated.

Two natural red varieties gave, in  $F_2$ , three definite groups:— *a*) full red grain, *b*) grey-brown grain and *c*) white grain, in the ratio 9 (red) : 7 (grey-brown  $\times$  white) as if the red were due to the simultaneous presence of two factors one of which by itself produces the grey-brown type. On the other hand, further investigation including  $F_3$  and  $F_4$  tends to show that full red is due to one single determinant, which produces red in the presence of the purple pigmentation factor, and grey-brown in its absence.

**753 — Improving Alfalfa by Selection and Hybridisation in Manitoba, Canada.** — **SOUTHWORTH**, W., in *The Agricultural Gazette of Canada*, Vol. V, No. 2, pp. 158-162 + 2 Figs, Ottawa, February, 1918.

The experiments described have been carried out since 1915 at the Manitoba Agricultural College with the aim of producing types of alfalfa suitable for forage and seed, and, at the same time, resistant to the low temperatures of the Canadian winter.

**PURE STRAIN SELECTION.** — At present the plants being tested number 4 000 and belong to 8 different strains, one of which seems to unite in good proportions a high forage yield and high seed yield.

**HYBRIDISATION.** — By crossing common alfalfa (*Medicago sativa*) with the yellow-flowered type (*Medicago falcata*) known for its resistance to

low temperatures, 31 plants were obtained in the  $F_1$  which are remarkable for their strength and vigour.

It is hoped to isolate types valuable both for their yield in forage and resistance to cold.

**754 — Sugar Beet Seed Production and Stock of the United States.** — I. Beet Seed Crop of 1917 Larger; Acreage Smaller, in *Facts About Sugars*, Vol. VI, No. 2, pp. 27, New York, 1918. — II. Beet Seed Report Issued, *Ibid.*, No. 13, pp. 253. — III. Country Has Ample Beet Seed Supply for Season, *Ibid.*, No. 15, pp. 287. (1).

The sugar beet seed production of the United States during the year 1917 is reported by the Department of Agriculture at 5 546 000 lb., an increase of 335 000 lb. or rather more than 6 per cent over the crop of 1916. While the seed production was larger, the acreage devoted to cultivation of seed beets was 13 per cent less than in 1916, the crop of 1917 being grown on 4 579 acres, as compared with 5 268 acres devoted to seed beets in the preceding year.

The far western States of California, Idaho and Utah were responsible for the increase in production in 1917, the other seed producing areas showing a decrease. In these three states the crop last year was 2 458 000 as against 1 628 000 lb. in 1916, a gain of 51 per cent. The acreage devoted to seed production in these States was 2 523, as compared with 2 178 in the year before, an increase of 15 per cent.

In the other great seed producing area, embracing the states of Colorado, Kansas, Nebraska and Montana, the seed crop of 1917 was 12  $\frac{1}{4}$  per cent. smaller in 1917 than in 1916, the figures being 3 030 000 lb. for last year and 3 445 000 lb. for the year before. In 1916 this territory produced 66 per cent. of the country's total seed crop while last year its production was only 54.5 per cent. of the total. The acreage devoted to seed beets decreased in this territory from 2 723 acres in 1916 to 1 978 acres in 1917, a decrease of nearly 28 per cent.

Beet seed production in Michigan and Ohio in 1917 was only 58 000 lb., as compared with 128 000 lb. in 1916, a falling off of more than half. The area in seed beets in these states decreased from 365 acres in 1916 to only 78 acres last year.

In point of production per acre the Colorado-Kansas-Nebraska-Montana territory made the best showing, obtaining an average of 1 532 lb. of seed to the acre, as against an average of 974 lb. to the acre for California, Idaho and Utah and an average of 744 lb. to the acre for Michigan and Ohio. The Great Western Sugar Company, the Utah-Idaho Sugar Company and the United States Beet Seed Company were the country's largest producers.

According to the final figures on sugar beet seed stocks in the United States on January 31, 1918, as collected by the War Emergency Seed Survey, there were on hand 19 240 571 lb. of imported beet seed and 7 927 614 lb. of home grown seed, a total of 27 168 185 lb.

As compared with the corresponding date of 1917, the report shows an increase of 3 740 918 lb. in the stock of imported and 2 405 443 lb. in the

(1) See *R.* 1917, No. 139. (*Ed.*)

stock of domestic seed, making a combined increase of 6 236 361 lb. or nearly 30 per cent., during the year. Importation of sugar beet seed into the United States during the twelve months' intervals, as reported by the Department of Commerce, amounted to 15 437 797 lb.

Checking up these figures for stocks on hand at the two dates and of receipts in the interim, it appears that the domestic sugar beet crop of 1917 required in the planting a total of 14 747 436 lb. of seed. The beet acreage for 1917 is estimated by the Department of Agriculture, at 675 400 acres, which works out at an allowance of 21.8 lb. of seed to the acre. This, however, takes no account of replantings nor of acreage planted which yielded no crop.

As regards seed supplies for the coming season and for that to follow it is apparent that there is sufficient seed on hand to plant a normal beet acreage for 1918, including the necessary replantings, and that after the planting season is over there should be a surplus of from 20 to 25 per cent. of the sugar beet seed requirements for 1919. Very little sugar beet seed has been imported since January 31, 1918, and it is not probable that any large quantity will be imported before the close of the 1918 planting season.

In view of the small surplus that will remain after the 1918 planting has been finished, it is evident that a considerable increase in domestic seed production, together with a large importation of seed, will be necessary in order to make possible a normal sugar beet acreage in 1919. Reports indicate that the beet sugar companies are awake to the situation and are preparing to increase their seed production this year.

755 — **The Best Varieties of Italian Rice.** — NOVELLI, N., in the *Giornale di Agricoltura della Domenica*, Year XXVIII, No. 17, p. 89 + 1 Figs. Piacenza, April 28, 1918.

The great number of varieties of Italian rice is a disadvantage which the "R. Stazione sperimentale agraria di risicoltura" of Vercelli is trying to overcome by selection, organisation of the production of selected seed, and the supply of such seed to growers. This would allow the cultivation of a limited number of the best varieties of rice.

The most productive varieties are known as "common", whereas the "semi-fine" or "fine" ones are earlier and more appreciated for the quality of their produce. At the present time, when a large production is essential, the author advises that the following varieties be sown: — "Chinese originario" or "Abbondanza"; "Onsen", now acclimatised and grown in North Italy on account of its very high yield and relative earliness; some of the good early types derived from "Chinese originario" (1) more suited to cold, shady soils and late sowing; these rices do not suffer from lack of nitrogenous fertilisers because they have little herbaceous growth and much seed — 60 % or more of paddy and 40 % or less of straw; "Lencino", which in suitable soils gives very high yields and does not drop its grain, even when ripe; "Ranghino" (2); "black" and "yellow Vialone". As varieties for transplanting "Chinese originario" and "Onsen" are especially recommended because they tiller rapidly and give a maximum crop. Where

(1) See R. 1917, No. 330. — (2) See R. 1916, No. 34. (Ed.)

it is necessary to increase the acreage under cereals at the expense of fields already fertilised and prepared for forage, it is advisable to make the first and most important cut of hay, then to transplant the rice, which in the meantime, has been grown in seed-beds.

To encourage the transplanting of rice the Ministry of Agriculture offers rewards of 30 to 50 lire per hectare (about 10s. to 16s. pr acre), to be divided between the most skilled growers and labourers.

756 - "Early Dellarole" Rice. — MARCARELLI, B., in *Il Giornale di Risticoltura*, Year VIII, No. 3, pp. 35-38 + 1 Fig. Vercelli, March 31, 1918.

This variety was isolated in 1911 from a rice from China by Signor NICOLAS DELLAROLE of Vinzaglio (province of Novara) who tested it under the most varied conditions. Having convinced himself of the constancy and uniformity of the descendants, he distributed it for cultivation on a large scale. It is now used not only in the districts bordering on that from which it originated, but also wherever it has been tested.

The principal characters of this new rice are:— easy adaptation to the most varied soils, perfect grain from a commercial point of view, marked earliness. As it ripens in 120 to 130 days from the date of sowing, it is much to be recommended for old rice fields with cold damp soil so long as the irrigation water is warm. It also does well in new fields, converted from meadows, so long as nitrogenous fertilisers are not used excessively, as in this case it lodges. The author describes it as follows:— erect, little inferior in vigour to "Chinese originario"; culm relatively thin, not very resistant to lodging, arched at the cyme with white nodes, leaves removed from the culm, short and light green till earing, panicles rather close and arched, of average length and breadth, with long spikelets at their base; caryopses few, longer than those of "Chinese originario", of a fine straw colour when ripe; glumes not very thick, almost or entirely glabrous, with slightly defined sides and rudimentary awn; glumelles well developed, white, standing out well at the base of the glumes. The interior of the caryopsis contains a very thin, light perisperm (coat) and a compact, vitreous endosperm (albumen), giving a very transparent, pearly, commercial product which is much appreciated.

Tillering is limited, but hardly inferior to that of most early rices, and the ratio between the weight of grain and that of straw is about equal to that of "Chinese originario".

Ripening occurs during the first days of September, whatever the date of sowing (from March to the first week of May) and is rarely as late as the middle of the month. The yield is from 1.79 to 1.83 tons of paddy per acre; under the best conditions this yield may reach and even exceed 2 tons per acre.

Examination of the culms, panicles, caryopses, etc., gave the following result:—

Average height of plant . . . . .	90-100	cm.
Length of panicles . . . . .	17-20	"
Number of spikelets per panicle . . . . .	7-9	

Length of spikelets from the base . . . . .	8-10	cm.
*      *      *      * cyme . . . . .	6-7	*
Number of caryopses per panicle . . . . .	90-120	
Weight of 1000 rough grain (paddy) . . . . .	29.8-29.9	gm.
Weight of 1 litre of paddy . . . . .	500-600	*
Number of rough grains, per litre . . . . .	17750-21000	
Size of rough grains { length . . . . .	7.75-7.90	mm.
frontal diameter . . . . .	3.50-3.65	*
side . . . . .	2.25-2.30	*
Yield of cleaned rice { commercial type . . . . .	68-69	%
inferior type (cracked grain) . . . . .	6-5	%
Date of ripening . . . . .	first days of September	
Yield of paddy per acre . . . . .	1.75-1.99	tons.

In view of its great earliness the new variety does not attain the maximum yield of "Chinéso originario". It is advisable to sow it rather closely, not less than 1.11 to 1.19 cwt. of paddy per acre and 1.36 to 1.43 cwt. per acre when it is sown very late in old fields with cold soil,

**757 — Cultivation of Edible Leguminosae in Tunis for the Production of Dry Seeds.**

— *Bulletin de la Direction générale de l'Agriculture, du Commerce et de la Colonisation de la Régence de Tunis*, Year XXI, No. 92, pp. 138-184. Tunis, July, August, September, 1917.

In view of the increased price of dry seeds of edible Leguminosae, it is in the interest of Tunis to develop the cultivation of these plants. The conditions in the country are such that extended cultivation of these crops will in no way restrict that of others and may even prove favourable to cereals.

A general outline of the economic and environmental conditions, parasites and diseases is given, followed by a description of the principal crops, containing information useful to all those interested in Tunis.

There are some Leguminosae among those described which are of particular interest. The cultivation of beans, horse beans and chick peas, already adopted over wide areas of the Regency, should be yet more widely extended. Lentils, one of the Leguminosae hitherto little cultivated, should do well and give a high yield per acre. Peas could also be grown with good results and fetch high prices; in normal times France imports nearly 900 000 cwt of peas annually.

The dwarf bean is less strong and needs favourable positions. For this reason its cultivation must be tested for some time before its extension can be recommended.

**758 — *Canna edulis* in Trinidad.** — *FREEMAN, W. G.*, in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Pt. 4, p. 174. Trinidad, 1917.

As in many other tropical countries *Canna edulis* is abundant in Trinidad and Tobago, where it is known as "tous les mois". It is cultivated in gardens, and, in cases where it has escaped cultivation, grows wild. The boiled roots may be eaten by human beings, and, in some countries such as Queensland, they are used for the extraction of starch. A sample analysed at Hawaii showed the following composition for the small and big roots respectively, the composition being similar to that of the potato: — Water

81.58, 65.86; nitrogen-free extract 15.57, 31.34; protein 1.37, 1.20, fat 0.13, 0.15, fibre 0.54, 0.64; ash 0.81, 0.81.

The plant is easily grown by planting pieces of the root at distances of 1 foot in rows 3 or 4 feet apart. It takes from 6 to 8 months to ripen, and, at Trinidad produces about 15 tons per acre. The roots keep well, and when stored in sacks do not decay for three months.

Recently (*Report of the Hawaii Agricultural Experiment, 1916*) the cultivation of this plant as a food for pigs was recommended.

**759 - *Canavalia ensiformis*, and *C. gladiata* in Trinidad and Tobago.** —

SHREWSBURY, HERBERT S., in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Pt. 2, pp. 65-67; Pt. 4, pp. 224-225. Trinidad, 1917.

Since 1915 *Canavalia ensiformis* has made considerable progress in Trinidad as a cover crop in coconut and cacao plantations. The fact that the dry beans (white) are edible makes it preferable to other cover crops. It is also a good quality forage. *C. gladiata*, is similar to the preceding plant, but of stronger growth with brownish-yellow or red seeds. It may be put to the same uses.

Analyses of the seeds, the results of which are given below, showed that the two species contain no hydrocyanic acid:— *C. ensiformis*. — Water 15.5, carbohydrates 45.2, protein 27.6, fibre 5.4, ash 3.1, fat 3.2, food units 122; weight of whole bean 1.97 gm., percentage of skin 14.4. *C. gladiata*. — Water 12.7, carbohydrates 53.6, protein 25.1, fibre 2.4, ash 2.9, fat 3.3, food units 125; weight of whole bean 2.73 gm., percentage of skin 15.5.

The nutritive value of these beans is equal, or even superior, to that of French kidney beans.

**760 - Growing Sorghum in Kansas.** — CUNNINGHAM, C. C., and KENNEY, RALPH, in *Agricultural Experiment Station, Kansas State Agricultural College Bulletin No. 218*, 54 pp., 15 tables, 24 Figures. Manhattan, Kansas, 1918.

The authors base their statements on experimental data and the experience of practical farmers in all parts of Kansas. The summary of their work is given below.

The sorghums are more resistant to heat and drought than maize. They are, therefore, more profitable in those sections where, because of drought, hot winds, and shallow soils, maize is not a reliable crop. Sorghum will outyield maize as a forage or silage crop in any part of the state.

Sorghum leaves the ground in poor condition for the following crop, and is therefore commonly considered hard on the ground. Pound for pound of material produced, sorghum does not remove more fertility than other crops.

Crops that make their growth during the latter part of the growing season should follow sorghum rather than autumn or early spring seeded crops like wheat or oats.

The varieties of grain sorghum most extensively grown in Kansas are Blackhull kafr, Pink kafr, Dwarf Blackhull kafr, Dwarf milo, and Peterita. Blackhull kafr gives best results with favourable conditions. Pink

kafir yields better than the Blackhull variety on poor soils or in unfavourable seasons, or where the growing season is too short for the latter. Dwarf milo and feterita and other early varieties are grown where the season is too short, or the rainfall too deficient, for Pink kafir. The varieties of the sorgos or sweet sorghums most extensively grown in Kansas are:— Black Amber, Red Amber, Orange and Sumac. The Red Amber is the best variety for western Kansas. Kansas Orange and an early strain of Sumac are best for eastern Kansas.

Three methods of planting the sorghums are employed in Kansas:— surface planting, open furrow planting, and listing. Surface planting is best on heavy, poorly drained soils in eastern Kansas. The open furrow method, which consists of seeding in rather shallow furrows made by two discs set on either side of the planter shoe, usually gives the best results in eastern Kansas, where drainage is good and rainfall abundant. Listing is practical, and generally the best method in western and central Kansas.

Usually the sorghums should be planted about ten days later than maize.

Rowed sorghum for grain should be seeded at the rate of 4 to 8 pounds per acre, depending on the soil and rainfall. If grown for forage or silage this amount should be doubled. Sorghum broadcasted or drilled for hay should be seeded at the rate of 1 to 2 bushels per acre. It should be sown later than sorghum for grain. Rowed sorghum should receive as thorough cultivation as maize.

The proper stage to harvest rowed sorghum depends on the purpose for which it is intended. Sorghum for feed should be cut when the grain is in the dough stage. For silage it should be cut when in the hard dough stage, or nearly ripe. For grain, it should be cut when fully mature. For syrup it should be harvested in the dough stage. Sorghum drilled or broadcasted for hay should be cut in the milk or soft dough stage. It makes the best quality of feed when it reaches the proper stage for cutting just before frost.

Sorghum cross-fertilises readily, which almost always results in deterioration. Continual roguing to remove hybrid and foreign heads is necessary to maintain a pure variety. Sorghum seed for home use should be field selected and kept in the head until planting time.

Sweet sorghum is utilized to a limited extent in Kansas for syrup production. This industry is increasing.

The grain sorghums, kafir, milo and feterita, when properly fed, are but slightly inferior to maize for feeding livestock. They are similar to maize in composition, but are not as palatable, and a smaller percent of the nutrients is digestible. Feeding tests carried out at the Kansas Agricultural Experiment Station indicate that they have from 85 to 90 per cent of the feeding value of maize for fattening hogs and cattle and from 90 to 95 per cent for fattening sheep. Sweet sorghum and kafir make excellent forage. Sorghum silage is about equal to maize silage.

The sorghums are comparatively free from diseases and insect enemies. Kernel smut is the only serious sorghum disease in Kansas. This

can be readily controlled by treating the seed with formaldehyde (40 per cent solution). Chinch bugs, grasshoppers and the kafr ants are the only insect enemies that seriously damage sorghum in Kansas.

161 — **Experiments on the Cultivation of *Paspalum dilatatum* in the Colonial Garden of Palermo.** — *Boletino di Studi ed Informazioni del R. Giardino coloniale di Palermo*, Vol. IV, Pt. 2, pp. 54-57. Palermo, 1917.

*Paspalum dilatatum*, grown in the Colonial Garden of Palermo, did very well without irrigation. It reached an average height of from 3.38 to 4.92 feet. Sown in autumn it was already well developed in April. It was cut during the first days of June and yielded 14 tons of hay per acre.

162 — **Oil Yielding Plants of Indo-China.** — *CREVOST, Ch.*, in *Bulletin économique de l'Indochine*, Year XX, New Series, No. 127, pp. 563-619 + 18 Plates. Hanoi-Hochphong, November-December, 1917.

The author (Agricultural and Commercial Inspector, and Curator of the Agricultural Museum), after having described the present situation in Indo-China with regard to the production of oil-yielding plants and oils, and its possible development, gives a detailed list of the oil-yielding species capable of being used industrially or commercially. The plants are studied, classified in families, with their scientific names, synonyms, common and native names, geographical distribution, description, extraction, and the quality and value of their oil.

**M yristicaceae.** — Knema, *Myristica glaucescens* Hook f. and Th. = *Knema corticosa* Lour = *M. corticosa* Hook f. and Thoms.

**Bixaceae.** — 1) *Luracran*, *Hydnocarpus antihelminticus* Pierre p; *Chaulmoogra* (1), *Taraktogenos Blumei* Hassk. = 3) *False chaulmoogra*, *Invocardia odorata* R. Br.

**Guttiferae** — 1) *Calophyllum inophyllum* Linn. = 2) *C. Thorelii* Pierre = 3) *C. Balansia* Pitard. = 4) *Garcinia tonkinensis* In. Vesque, Cay-loc (2).

**Ternstroemiacae.** — Tea-oil plant, *Thea sasangua* Nois = *T. oleosa* Lour = *Camellia drupifera* Lour.

**Malvaceae.** — Cotton plant: 1) *Gossypium herbaceum* Lin. and 2) *G. irtsum*.

**Bombacaceae.** — Kapok of Indo-China: 1) Silk cotton tree, *Eriodendron anfractuosum* D. C. = *Bombax pentandrum* Lin. = *Eriophorpos javana* Rumph = *Gossampinus alba* Ham. = *Eriodendron Rheedi* Planch. = 2) Silk Cotton Tree, *Bombax malabaricum* D. C. = *B. Ceiba* Lin. = *B. klapathylla*.

**Stereuliacae.** — 1) *Sterculia cochinchinensis* Pierre = 2) *St. ketida* Lin. = 3) *St. Pexa* Pierre. = 4) *St. Lewis* Wall. = 5) *St. alata* Roxb.

**Meliaceae.** — *Amoora* sp.?

**Simarubaceae.** — 1) *Irvingia malayana* Pierre = 2) *I. Oliveri* Pierre.

**Sapindaceae.** — 1) Soapnut tree, *Sapindus Mukorossi* Gaertn.

(1) See R. Dec., 1917 No. 1160. (2) See R., 1917, Nos. 136 and 824 (I.d.)

= *Pavieasia annamensis* Pierre. — 3) *Schleichera trijuga* Wild. = *Melicocca trijuga* Juss. = *Sch. pubescens oleosum* Pierre. — *Stadmannia Sideroxylon* — *Cusambium oleosum*.

Anacardiaceae. — *Buchanania latifolia* Roxb.

Moringaceae. — Horse radish tree, *Moringa pterigosperma* Gaertn.

= *M. oleifera* Lamk. = *M. zeylanica* Pers. = *M. polygona* D. C.

Leguminosae. — 1) Pea nut, *Arachis hypogaea* Lin. — 2) Soja = *Glycine Soja* Sieb. and Zucc. = *G. hispida* Miq. = *Dolichos Soja* Lin. = *Soja hispida* Mœnch.

Rosaceae. — *Parinarium Annamense* Hance,

Combretaceae. — Malabar almond tree, *Terminalia Catappa* Lin.

Cucurbitaceae. — 1) *Hodgsonia heteroclita* Hof. and T. — 2) *Momordica cochinchinensis* Spreng. = *Muricia cochinchinensis* Lour. = *Momordica mixta* = *M. dioica* Wall.

Pedalineae. — Sesame, *Sesamum indicum* Lin. = *S. luteum* Retz. = *S. orientale*.

Labiatae. — Perilla, *Perilla ocymoides*,

Sapotaceae. — Tonkin Bassia, *Dasiphilla Pasquieri* M. Dub.

Lauraceae. — 1) Litsea, *Litsea citrata* Bl. — 2) *Teranthera sebifera* Pers.

Rutaceae. — 1) Shaddock tree, *Citrus decumana* Murr. = *C. costata* Rafin.

Euphorbiaceae. — 1) *Aleurites montana* Wils. 2) Candle nut tree, *Aleurites moluccana* Forst., 3) *Stillinga sebifera* Michx., this is the Cá-soi (=tallow tree); this is followed by an extract of the report of M. GROSJEAN of the Lyons Mission in China, pp. 385-389; 4) *Rotella sebifera*; 5) Croton, *Croton tiglium* Lin.; 6) Physic Nut tree, *Jatropha curcas* Lin.; 7) Makken; 8) Castor Oil, *Ricinus communis* Lin.; 9) *Hevea brasiliensis*

Urticaceae. — Hemp; 1) *Cannabis sativa* Lin. and 2) *C. gigantea*.

Coniferae. — Pine.

Palms. — 1) Coconut, *Cocos nucifera* Lin. — 2) Oil Palm, *Elaeis guineensis* Jacq.

763 — **Coffee in Abyssinia.** — SPALLETTA, A., in *L'Agricultura Coloniale*, Year XI, 1st. Half-Year, No. 1, pp. 70-88; No. 2, pp. 111-132 + 2 Plates; No. 3, pp. 196-222 + 1 Map; No. 4, pp. 284-297; Bibliography of 138 Publications. Florence, February 28, April 30, June 30, August 31, 1917.

WILD AND CULTIVATED SPECIES AND VARIETIES. — Coffee is not a native of Arabia, as many wrongly believe, but of the high mountains in the southwest of Abyssinia, where it grows wild and where the purest, most aromatic, and most appreciated varieties are found. The wild or cultivated Abyssinian varieties are: "Ennaria" or "Naria", "Arrari" or "Arratino", "Zeghié", "Gentel".

The "Ennaria" coffee plant is the stock from which all the other existing varieties are derived. "Ennaria" coffee closely resembles "Mocha"

(1) See R. Sept., 1917, No. 853. (Ed.)

coffee, with which it is sometimes mixed, and which it frequently surpasses in quality. It has two sub-varieties: — "Caffa" (the district where it originated) and "Ennaria" properly speaking, derived from the other Galla districts. The seed of the first variety is smaller, rounder, and of a darker green than that of the second, which is elongated.

The "Arrari" coffee plant takes its name from the place where it originated. This coffee is sometimes mixed with Mocha. There are two sub-varieties: — "Arraro", from near the town of Arrar, with elongated seed (hence its English name of "longherry"); "Itiou", in the district of the Itiou-Gallas and Arussis, with small, yellow seed; the colour is due to the fact that it is only put on the market 2 or 3 years after being harvested, so that it is thoroughly dry.

The "Zaglié" variety comes from the Lake Tzana district, near Zaglié and Quorata. It is the least appreciated quality on account of its lack of aroma.

The "Gentel" variety differs from the preceding one by the manner in which the seed is treated; it is produced and consumed almost exclusively in the Oollo-Gallas district; it has a very agreeable, rather strong flavour.

**CENTRES OF COFFEE PRODUCTION IN ABYSSINIA.** — There are three principal centres: 1) the basin of the Omo and Didessa; 2) Arrar and neighbourhood; 3) Tzana Lake district in Godjam.

The first, by far the most important, is the original centre of the coffee plant which grows there wild on the hillsides and in the valleys at a height from 4 920 to 6 560 feet, forming almost exclusively the vegetation of the undergrowth, and sometimes of the clearings, in the forests. It is also cultivated. In the Lake Tzana district the coffee plant was introduced at a very remote date and has become semi-wild.

**CLIMATE AND VEGETATION.** — Abyssinia includes three large climatic zones: — 1) the lower or "quella" called by the Gallas "worebo"; 2) medium or "voine dega" called by the Gallas "worebo angescho"; 3) upper or "dega", called by the Gallas "angescho". The first is a district of great depressions or valleys below 4 920 feet, hot, damp (as the result of water-courses, lakes, and periodical rains), with a luxuriant vegetation. This zone is not cultivated because it is unhealthy; the natives go down there from the table-lands only to collect the ripe fruit of the wild coffee plants. The second zone is widely cultivated, with a perpetual spring, where all the European fruit plants flourish and give as much as three harvests a year. Its altitude is from 3 950 to 9 840 feet. The third, above 9 840 feet, is the zone of wide pasture lands, and above it are the eternal snows.

**SOIL.** — That of the Tzana Lake district is alluvial, cool and very fertile. In Arrar the coffee plant flourishes in granitic soils and ceases growing in the clay soils. In the Galla district the soil is volcanic and very fertile.

**CULTURAL METHODS.** — The woody or herbaceous vegetation of virgin soils is destroyed by fire. The soil is ploughed and sometimes, manured, and sown before the rainy season. The irrigation, even when

primitive, is practically sufficient. The sole cultural care is the removal of weeds.

Nurseries are rare in the Galla district. As a rule, at the rainy season, the natives go to the forest and choose young plants for sowing. These they place obliquely in the soil, with the earth attached to them, at a depth of from 12 to 14 inches, covering them with soil so that only about 4 inches of the plant is above ground. If an adult plant is used it is topped to about 7 inches.

When nurseries are formed the seeds are sown as soon as they are extracted from the ripe fruit. The young plants are only transplanted when they are at least 28 inches high, *i. e.*, at the end of one or even two years. Permanent plantations contain 800 plants. The first flowering occurs one year after transplantation and before the rains, *i. e.*, in April. The first harvest is made two years after the first flowering. The plant reaches a height of 10 to 16 feet (sometimes 20), and lives and bears fruit for 20 years, in rare cases 30.

In Arrar the cultivation of the coffee plant is rational and intense. In the Tzana district the plant is semi-wild and is not cultivated, the coffee alone being harvested.

Finally the author studies the commercial routes through which Abyssinian coffee passes and considers the future of the cultivation of the plant in that country.

764 - **Tobacco in Honduras.** — MAKINSON, G. A., in *Commerce Reports*, No. 288, pp. 959-952. Washington, 1917.

Honduran tobacco has always enjoyed a preeminent position in the estimation of Central American tobacco smokers, so much so that native tobaccos of the neighbouring Republics are often put on the market under the name of "Tabaco de Honduras" in order to obtain higher prices. It is commercially known as "Copan tobacco", because the best quality and largest quantities are produced in the Department of Copan, which borders on both the Guatemalan and Salvadoran frontiers. It is also produced in commercial quantities in the Departments of Ocotepeque, Gracias, Santa Barbara, and El Paraiso, the capitals of the respective Departments being the marketing centres. The estimated average annual production of each district is as follows : Paraiso, 7 500 lb.; Santa Barbara, 250 000 lb.; Gracias, 50 000 lb.; Ocotepeque, 410 000 lb.; and Copan, 1 000 000 lb.

*Planting, Harvesting and Curing.* — Tobacco is planted during October — that is, from 2 to 4 weeks before the close of the rainy season — so that the young plants have sufficient time to take root before the long dry season sets in. The seeds are planted in nurseries during July and the young sets transplanted about 4 months later. One pound of seed should produce approximately 20 000 plants, and growers place about 2 250 plants to the acre.

The leaves are ready for gathering between February and April and the custom is to start harvesting as soon as the plant has fully developed;

this is sometimes determined by the appearance of yellow tints in the leaves or when the leaves show signs of brittleness on being doubled or bent. The stock is cut whole a little above the roots and the seed is obtained later from the suckers that sprout from the remaining lower part of the stem. The stocks are then hung out, head down, in the open air and exposed to the sun. If any are harvested in the rainy season (which is rare) they are dried in the shade. After being dried in the sun for 15 or 20 days the stocks are pressed for 3 days and the leaves are then separated from the stems and sorted into 3 grades, according to size. They are then tied in bundles of 1 lb. each — the stems being utilized for fastening — and are alternately pressed and sunned until the veins are thoroughly dried. Owing to negligence and the varying judgements of different farmers the resulting product is not always uniform, which sometimes results in obtaining lower prices. Dried leaves average from 9 to 20 in. in length, and a well-cultivated acre should yield from 400 to 650 lb.

Both strong, mild, dark and light tobaccos are produced, these properties depending largely upon the nature of the soil and, to a somewhat lesser extent, upon the amount of rainfall and the time and method chosen for cutting and curing. If the plants are permitted to ripen thoroughly the leaves will be rather dark in colour, whereas if cut earlier a lighter shade will be obtained. A poor, sandy soil is said to produce a mild tobacco and a rich clay soil a somewhat stronger plant. In seasons of copious rainfall it is noticed that the leaves are invariably of a dark hue.

*Cost of Production.* — It costs from 8 to 12 cents United States currency to raise a pound of tobacco in Honduras, and the market price ranges from 15 to 25 cents, depending on the class and quality. It is supposed that most of the tobacco cultivated in Honduras was originally derived from Cuban seed, and the more progressive growers still continue to import Cuban, Jamaican, Porto Rican, and American seed. When ready for market Honduran tobacco closely resembles that grown in North Carolina and Virginia. It burns well and has a pleasant aroma, and connoisseurs state that its failure to achieve just recognition of its worth is due solely to the primitive and unscientific methods employed in its harvesting and curing.

*Methods of Packing — Export Trade in Tobacco.* — Tobacco is packed for shipment in bales of 100 lb. each, which are well wrapped in several layers of banana leaves and tightly tied with strong banana fibre. Although apparently crude, this method of packing is considered the most practical, combining as it does the qualities of lightness and cheapness.

As the tobacco fields of Honduras are in closer proximity to the railroads and seaports of Salvador and Guatemala than to those of Honduras, nearly all the crop is strapped on the backs of native Indian runners or mules and carried over the frontier trails to the neighbouring Republics. These caravans pass the border at remote hamlets, where no customs are established, so that statistics showing the volume of this trade are not available. However, it is well known that practically all of the highgrade cigars and cigarettes manufactured in Central America are either of pure

Honduran tobacco or contain a large admixture of it. The amount and value of tobacco exports through the seaports of Honduras for the years 1915 and 1916, respectively, were 56 800 lb., worth \$6 810, and 89 025 lb., worth \$19 610.

Honduras tobacco, after being manufactured into cigars and cigarettes in Guatemala and Salvador, is exported in considerable quantities to South America, particularly Peru, the Caribbean countries, and Europe. The volume of this business amounts to many thousands of dollars annually.

*Efforts made to expand industry and markets.* — Of recent years, the Honduras Gouvernement has taken measures to foster the industry, and aside from maintaining several schools where young natives are taught to cultivate and cure the crop scientifically, steps are being taken to improve the quality of the plants and to find new outlets for the constantly increasing production. The Government recently sent several youths to the tobacco districts of Cuba, where they were able to study the up-to-date methods employed there in the various branches of the industry.

Tobacco is principally used in Central America for cigars and cigarettes; pipe smoking and chewing have not been introduced among the natives, although nearly all of them, including minors and women, smoke. Among the labouring classes the women of nearly every household prepare the cigars and cigarettes for the family needs. During the fiscal year 1914-15 \$7 480 worth of cigarette paper was imported, the greater part of this supply coming from Spain and small shipments from the United States and Germany.

Up to the present no attempts have been made to manufacture high grade cigars or cigarettes on a large scale, although with an abundance of raw material and cheap labour it would seem to warrant a careful investigation. Nearly every man and woman of the labouring class understands the rudiments of cigar making, although none of them are particularly expert at it. However, they could soon be trained to turn out as good cigars as are manufactured in Cuba. An almost unlimited supply of this labour could be obtained at from 25 to 50 cents per day. Cigar factories in Guatemala utilize native labour and their products (Honduras tobacco with Sumatra wrappers) are said to compare favourably with those of many factories in Cuba, Porto Rico, and the Philippines.

In addition to supplying the demand for good cigars in Honduras itself, a profitable market could be worked up among the other Central American Republics.

**765 — Marvel of Peru (*Mirabilis Jalapa*), a Plant which should be Utilised.** — MANCADA-GUIGNONIÈS, FRANCESCO, in *La Ricerca Agricola*, Year XIV, Pt. 3/2, pp. 112-113, Rome, May 1, 1918.

The author has made a long study of this plant and concludes that its cultivation for various industrial uses is advisable.

When grown in gardens the plant flowers excessively, to the detriment of the seed, which is small. In arid soil, however, especially if fertilised with ashes, it flowers less, and the seeds are much larger and richer in starch.

The stamens, pistils, and perianth (which dries up without separating from the seed) give a fast purplish colour which dyes silk.

The starch contained in the seed is of very good quality. When freed from the husk and germ the seeds give a very fine flour, which may be used or making bread, paste, biscuits, etc.; they may also be subjected to alcoholic fermentation as they contain a sugar.

The cultivation of this plant in malarial districts would be very advantageous; the flowers open in the evening and during the night give off a very strong smell which keeps away mosquitoes, or stupefies them, thus making them inoffensive.

66 - "Chamiso" (*Atriplex canescens*) and "Quelite Salado" (*Atriplex acanthocarpa*), Plants of the Arid Districts of North Mexico Suitable for growing in Saline Desert Soils. — PATONI, CARLOS, in *La Revista agrícola, Órgano oficial de la Dirección de Agricultura, Secretaría de Fomento, México*, Vol. 1, No. 2, pp. 48-49. Mexico, September 15, 1917.

"Chamiso", or "costilla de vaca", or "costilla" (*Atriplex canescens*) is found in northern Mexico, New Mexico and Texas. The variety most common in Mexico is *angustifolia*, which prefers rich, strong land, and, though not of necessity halophytic, also does well in medium soil, and can stand perfectly well sodium salts such as chloride or carbonate. It grows to a height of from 3.28 to 4.92 feet and its foliage is about 6.56 feet in diameter. Its leaves are tender and good as forage. The wood is used as fuel.

The "quelite salado", or "saladillo" (*Atriplex acanthocarpa*, which must not be confused with another plant also called "saladillo", the Chenopodiaceae *Suaeda Torreyana* or *S. Moquinii*) is found in the same districts as the preceding species, but is smaller and of more rapid growth because it is entirely herbaceous. It is always halophytic. Its leaves are more tender and appetising, and sodium is extracted from its ash.

The author recommends that these plants be sown or transplanted to cover the dried-up soil of the old bed of the Lake of Texcoco.

67 - The "Miaray" (*Citrus miaray* n. sp.), a New Citrus Fruit of the Philippines. — WESTER, P. J. (Agricultural Adviser, Department of Mindanao and Sulu), in *The Philippine Agricultural Review*, Vol. X, No. 4, pp. 456-457. Manila, 1917.

The Philippines already hold first rank in the number of indigenous forms of the genus *Citrus*, and this very fact is a promise of discovery of still unrecorded species in the less explored regions of the Archipelago. Apart from a purely botanical point of view, new forms are at present also of great interest as opening up new possibilities in hybridization, especially in connection with the problem of breeding new types resistant or immune to the citrus canker, *Pseudomonas citri* Hasse.

The "miaray" (*Citrus miaray* n. sp.) described and named by the author, was found by him in August, 1917, in Impolotao in the interior of the Province of Bukidnon, Mindanao, at an elevation of 750 metres.

With its willowy, slender, drooping branches and dense crown of dark green foliage, the miaray is an exceedingly handsome ornamental tree

about 6 metres in height. The fruit is about the size of a lime. It is pleasantly acid and may be used like the lime. The clean, vigorous growth of the tree indicates that it is likely to prove a desirable stock for other cultivated varieties of the citrus.

768 - **Soil Management Investigations in a Young Apple Orchard.**—WOODBURY, C. G.

\*NOYES, H. A. and OSKAMP, JOSEPH, in *Purdue University, Agricultural Experiment Station, Bulletin No. 205*, Vol. XX, 52 pp., XXIII Tables 12 Figs. Lafayette, Ind. September, 1917

The object of this investigation (carried on at Laurel, Indiana) has been to study the effects, and particularly the factors responsible for the effect of tillage with cover crop, mulch and sed on apple trees. The present report covers the formative period of the life of the trees. The land comprising the experimental plots had been used as a permanent pasture for nearly 40 years previous to planting the orchard. The investigation has to do mainly with the upland area, the hillside plot being included for any additional light it might throw on the behaviour of the upland plots. The systems of soil management include four major treatments, viz., clean cultivation with a winter cover crop; a heavy mulch of straw applied to the trees and the grass cut and let lie; the grass cut and allowed to lie where it falls, no mulch given the trees; the grass cut and raked up to form a mulch collar about the trees.

The Laurel soil contains a high percentage of silt and clay, and varies but little in its physical composition, specific gravity and water-holding capacity. The soil (to a depth of 9 in.) is not notably deficient in any essential element, however it is not very productive. The low organic matter content and the high proportions of silt and clay, make the soil one through which water percolates slowly and one which is easily puddled; coupled with these conditions is a slight acidity. The subsoil is not greatly different from the surface soil.

The average annual precipitation during the five-year period 1912-1916 has been 38.71 in. The spring months are usually much better supplied with moisture than the autumn months. Periods of dry weather frequently prevail in June and July, which are commonly broken by heavy precipitations in August.

While there have been no wide variations in phenological behaviour of trees under different systems of soil management, yet there does occur a marked slackening up of growth on grass plots during dry periods in summer.

Trees grown under a clean culture cover crop system or under a heavy mulch made 44.5 per cent greater average yearly gains in trunk girth than trees grown in grass with a light mulch or no mulch at all. There was no significant difference between the three varieties, Grimes, Jonathan and Stayman, in their response to soil management treatments. The Stayman variety made slightly greater gain in girth of trunk on all plots than did Grimes or Jonathan.

It is largely in dry periods that the value of certain systems of management in conserving soil moisture are made manifest. During two such

periods, occurring in June two out of the five years, where an adequate mulch was maintained on the surface of the ground either through the agency of cultivation or a heavy supplemental covering, the percentage of soil moisture was more than twice that in grass land. These soil moisture conditions are closely correlated with the girth increase made by the trees. The great importance of water in tree growth is further emphasized by a study of the precipitation data which show that the variation in growth due to seasonal moisture conditions, appears to have been quite as large as that due to cultural practices.

The soil temperature studies were carried out under field conditions (at a uniform depth of 9 in. on all plots) by means of soil thermographs. As the soil temperature is largely a reflection of the air temperature, the extent to which soil temperature can be controlled by cultural practices is quite limited. The data do not support the opinion that rain is of importance in warming the soil. There is no indication that the single factor of soil moisture had an influential bearing upon the temperature existing under the different systems of soil management. The temperature range varies inversely with the amount of mulch covering the soil. The role of soil temperature within the limits of ordinary cultural practice appears to be a neutral factor in tree growth in Indiana.

From a study of the chemical changes induced in the Laurel soil by cultural practices during the period 1910 to 1915, it appears that clean cultivation tends to deplete the soil of its organic matter, despite the fact that a cover crop is being turned under each year. The straw mulch plot has increased slightly in organic matter while the sod plots, as a whole, have come nearer to holding their own in volatile matter, humus and nitrogen than the clean culture cover crop plots. There is no apparent correlation between the previously mentioned chemical factors and tree growth.

A study of the average bacterial population shows that there are, in most cases, more bacteria present in the sod ground at Laurel than in the clean culture cover crop plots; that the variations in mulch on the sod plots have some influence on bacterial numbers; that tree growth and soil moisture cannot be correlated with bacterial numbers (1).

Tests show that ammonification varies with the season. Differences between plots are not consistent with seasonal climatic variations and it is impossible to say that cultural practice has affected the ammonifying power of this soil. Tests show that nitrification varies with the season, but that a growing crop of grass or rye lowers the nitrate content of the soil; that the most nitrates are found under the clean culture cover crop system, the straw mulch ranking second in amount of nitrates; that the girth gains of the trees are roughly proportional to the nitrate content of the soil; that there is no relation between the nitrifying power of the soil and either cultural practice or tree growth; however, the ratio between the nitrates present in the field and the nitrifying power of the soil does bear a relation to tree growth.

(1) See also *R.* April 1918, No. 301 (*Ed.*)

769 — **Experimental Projects of the Division of Pomology of the University of California.** — See No. 724 of this Review.

770 — **The Present Position of Hybrid Bearers.** — PERR-LABY, E., in *La Vie Agricole et rurale*, Year VIII, No. 13, pp. 219-221., Paris, March 30, 1918.

The author summarises the principal results of the annual report of the Commission of Investigation of the Central Agricultural Society of Haute-Garonne. This forms an interesting supplement to his study published in the same journal (1).

The cultivation of hybrids increases each year. It is taking foot in the fine wine-producing districts, such as Burgundy, Bordelais, etc., not to oust the established wines, but to supply the workers of the district with a very cheap, good ordinary wine, owing to the little care these vines require.

The Commission carried out its investigations chiefly in the department of Haute Garonne, and the departments bordering on it. The southwest of France is, moreover, the district in which hybrids are most extensively grown.

1. — **OLD HYBRIDS (BLACK).** — *Seibel* No. 71, — Does well direct in loam; irregular and small yielder in calcareous soils; very subject to anthracnosis under certain conditions.

*Seibel* Nos. 2\* and 63. — Larger producers and less sensitive than No. 1, especially 63; wine poor in alcohol; easily protected against mildew.

*Seibel* 128\*. — Was the most remarkable in 1917 on account of its fine, heavy yield, but it is very uncertain; very slightly subject to anthracnosis.

*Seibel* 138\*. — More regular and stronger than 128; its wine does not derive its colour from the pulp; largely grown because it can be planted direct.

*Seibel* 156\*. — Low resistance in certain environments, especially lime; must be fairly well protected against disease.

*Seibel* 2000\*. — To be preferred because of its greater resistance to disease and better quality wine; anthracnosis sometimes causes it to non-set in damp districts.

*Seibel* 2007. — Much in demand on account of its large fruit and its regularity in spite of its incomplete ripening.

*Seibel* 2003. — Does very well in loam; affected by lime.

*Couderc* 7103\* and 4401\*. — The first is preferred because it gives a larger yield, though the quality is inferior; subject to oidium.

*Couderc* 7120. — More popular than the two preceding ones because almost immune to oidium when planted in a relatively warm district or in an exposure which allows it to ripen its grapes which are of the third period.

*Couderc* 503. — Does not appear to propagate except at the beginning of hybrid planting; resistant to blackrot.

I. **NEWER HYBRIDS.** — A. *Black*. — *Seibel* 1121\*. — Much in demand on account of its good resistance to disease and regular yield.

*Seibel* 4613\*. — Much appreciated for its delicate and large grapes; needs sulphur spraying although not very subject to mildew.

*Couderc* 106-36. — Regular yield and high resistance to mildew.

*Malzique* 820-6\*. — Notable for the size of its bunch and grapes and its good quality wine; easily protected against mildew.

(1) See R. March, 1918, No. 303. To avoid repetition and to facilitate reference the hybrids already mentioned in article 703 are marked with an asterisk (\*). (Ed.)

*Malègue 1551-2* \*. — Heavier producer than 829-6; is better adapted to the eastern Pyrenees than the south-west because it requires more heat.

As a general rule Malègue vines should not be grown in soils favourable to anthracnose.

*Gaillard 194* \*. — Appreciated for its regular yield, which is average and does not need protecting when there is an invasion of mildew; in the Centre and East this vine is in demand on account of the quality of its wine; in the South and South-West where Aramon products are usual, those of 194 are considered too weak; its yield has been appreciably increased by strong pruning.

*Jurie 580* \*. — Gives a high yield and is very resistant to diseases.

*Baco 1*. — Little grown in the South-West on account of its small fruit and excessive bitterness which necessitates picking a fortnight before the normal harvest.

*B. Pink*. — *Seibel 2859* \*. — Is being more and more widely grown; strong foliage which does not require sulphate spraying when in a good exposure; suffers from excessive moisture which may be seen by the beginning of rot on the bunches.

*C. White*. — *Seibel 793* \*. — Almost immune; turns grey-pink when ripe; regular and fairly vigorous when planted ungrafted in good soils; its wine, though not very fine, is not of a bad flavour and fairly alcoholic.

*Seibel 850* \*. — Stronger; larger fruit; regular; foliage easily protected.

*Seibel 1880* \*. — Grown a little everywhere; wine better than that of 850, used in the South-West for making sparkling wine.

*Seibel 2653* \*. — Known as *Flot d'or*.

*Seibel 3021* \*. — Is without doubt a hybrid of the future; was much in demand in 1917.

*Seibel 4681*. — More resistant than 3021.

*Gaillard* or *Girard 157*. — Much spoken of; found by some to have too low a resistance; must be treated with sulphate 2 or 3 times, and with sulphur, 1 or 2 times; others consider it a large regular yielder of good grapes and worth the necessary treatments; the Commission found it in all the vineyards visited.

*Coudere 235-120* \*. — Good yield and resistance, but rots regularly before ripening.

*Malègue 1 647-8*. — Known as *Vert doré*; grapes of excellent flavour; foliage of good practical resistance.

*Malègue 1 157-1* \*. — Slightly less resistant but larger yielder.

*Malègue 1 897-12* \*. — Rather pretty bunches with a slight musk flavour.

*Berthe-Seyres 450* — Fine bunches with average fruit, slightly foxy and ripening in the second period.

*Maurice Baco*. — Fine foliage, heavy yield; maturity somewhat too late for certain districts in the South-West, slightly subject to mildew and especially grey rot.

**III.** — **NEW HYBRIDS.** — *A. Black* (1).

*B. White*. — *Seibel 4657* \*. — The author corrects his previous remarks (2); this vine does badly after the turning point that he has removed it from the list of plants to be recommended; as soon as ripe the grapes become loose and drop one after the other without the slightest shake; at vintage time only the bare stalks of the bunches remain.

*Seibel 4603* \*. — Another correction; at harvest time it is almost completely rotted; the author discards it too.

*Seibel 4762*. — Good resistance to mildew; neither bunches nor grapes are very large; they are excellent and very sweet, ripening in the second period.

*Seibel 5451*. — Higher yield than 4762, with much larger bunches and fruit, round, ending at the end of the first period; not very subject to rot; foliage less strong requiring some sulphate; grapes very sweet and of good flavour.

(1) There is nothing to add to that contained in No. 303 of March, 1918, p. 362. —  
) See No. 303, p. 361. (Fd.)

*Seibel* 4905. — Good yield; fine, well-flavoured grapes, less sweet than the two last; very regular; strong foliage resistant to mildew; ripening in the second period.

*Seibel* 5770. — Fine yield of good bunches with fruit above the average, ripening in the first late period; though very close the grapes do not rot; they are very good and very sweet.

771 — **The Larch.** — *SCHOTTE*, J. (Meddelanden från Statens Skogsförsöksanstalt), in *Skogs-  
försöksanstalten* Tidskrift, Year XV, No. 4-6, pp. 445-706 + 107 Figs. + 11 Tables.  
Stockholm, 1917.

This paper is a study on the genus *Larix* and its different species spread through the various countries of the globe made in view of their importance to sylviculture in Sweden. At the same time it is an important contribution to sylviculture in all countries. The author and his collaborators study above all the identification and geographical distribution of the different species of larch known throughout the world, their varieties, forest characteristics, susceptibility to disease and insect attack, production of wood, the quality and utilisation of this wood and the division of the different species of larch into pure and mixed stands. To distinguish the species are given two tables of identification, which enable the forester to distinguish 11 species of the 16 already known.

*Classification table of larch, based on the cones.*

I. — CONES VERY DEVELOPED (exceeding 2 to 2.5 cm. in length).

A) Bracts longer than the scales.

a) Straight bracts.

- 1) Scales with even edges . . . . . *Larix occidentalis* (1)
- 2) Scales with cut edges. . . . . *L. Lyallii* (2)

b) Curved bracts.

- 1) Cones 7 to 10 cm. high. . . . . *L. Griffithii* (4)

B) Bracts shorter than the scales.

a) Straight scales.

- 1) Bracts visible, ripe cones with neither hair nor down.
- α) smooth twigs. . . . . *L. europaea* (7)
- β) slightly downy twigs . . . . . *L. Potanini* (5)
- γ) hairy twigs. . . . . *L. olgensis* (14)

2) Bracts usually invisible, ripe

cones with down or hair. . . . . *L. sibirica* (10)

b) Scales with curved point . . . . . *L. leptolepis* (6)

II — SMALL CONES (Less than 2 to 2.5 cm. in length)

a) very small cones (length 1.5 to

2 cm.) . . . . . *L. americana* (18)

b) cones rather larger (length up to  
2.5 cm.)

1) Leaves about 3.5 cm. long. . . . . *L. dahurica* (12)

2) Leaves about 2 cm. long. . . . . *L. kurilensis* (15)

It should be noted that *L. chinensis* is not included in this table, though according to the descriptions available, its cones are very similar in character to those of *L. americana*, whereas the cones of *L. europaea* show considerable differences in measurements and form.

*Classification table of larch, based on the twigs and leaves.*

I. - HAIRY OR DOWNY TWIGS.

A) TWIGS COVERED WITH A GREYBROWN DOWN . . . . . *L. Lyallii* (2)

B) TWIGS SLIGHTLY DOWNY OR HAIRY

a) Leaves blueish-green, twigs reddish

1) Leaves about 2 to 3.5 cm. long. *L. leptolepis* (6)

2) Leaves about 2 cm. long . . . . . *L. kurilensis* (15)

b) Leaves green.

1) Twigs pendant, reddish when young, slightly hairy, leaves long (up to 4 cm.) . . . . . *L. Griffithii* (4)

2) Twigs non-pendant, upright; yellowish when young, downy, leaves long (up to 3 cm.) . . . . . *L. occidentalis* (1).

II. - TWIGS SMOOTH.

A) LEAVES RELATIVELY LONG (3 to 5 cm.); twigs dry with a strong smell of jasmin . . . . . *L. sibirica* (10)

B) LEAVES OF AVERAGE LENGTH (2.8 to 3.5 cm.); twigs fresh with a slight smell of balsam . . . . . *L. dahurica* (12)

C) LEAVES RELATIVELY SHORT (rarely more than 3 cm.) . . . . .

a) Twigs greyish-yellow, often with a slight smell of jasmin when dry . . . *L. europaea* (7)

b) Twigs reddish with small cones . . . *L. americana* (18)

The appended map (see p. 83) shows the geographical distribution of the various larches (16 species and 3 hybrids).

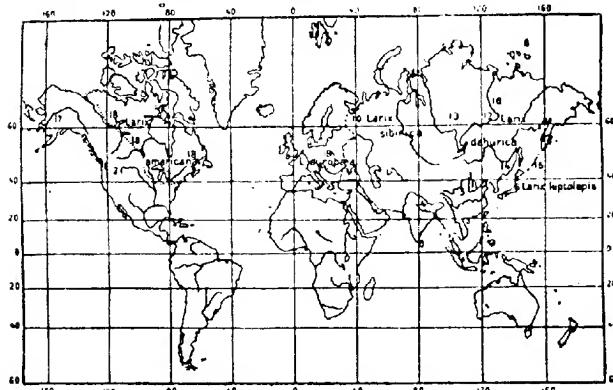
The following details are given on the use of larch in sylviculture, especially with regard to Sweden, for the most suitable species.

The European larch is grown almost all over Sweden up to Haparanda; it was imported in 1750 and the first plantations made in 1780 with seed obtained chiefly from Scotland. The plantations are remarkable for the size and regularity of the trunk and not very thick top, which has led the author to believe that there is a Scotch variety of the European larch. Since the middle of the 19th. century a large part of the larch seed used in Sweden was imported from the Tyrol, giving plantations with a high proportion of twisted trunks and of bad shape with an insufficient growth in height and a thick top. These characters make the Tyrolean larch unsuitable for mixed stands and of little value for the production of wood.

Scotch larch, on the contrary, may be profitably cultivated in the best forest soils, and soon produces timber ready for sale in about  $\frac{1}{3}$  of the time the Scotch pine requires to do so. Since the larch is fairly often subject to canker (produced by an ascomycete, *Dasyscypha Willkommii*), it is advisable to form plantations mixed with other trees wherever possible. For this

purpose plantations of Scotch larch mixed with Scotch pine or birch are to be specially recommended; spruce should be avoided, and, in any case, treated as a dominated tree. It is also advisable to use only seed of Scotch and Silesian larch, even though produced locally. The thinning of European larch should be early and intense, so that the first frees the tops and liberates the plants dominated. Intense low thinning should then be practised to eliminate the dominated trunks with bushy tops, especially if there is a dominated class in the plantation. These methods make the plantation more resistant to canker; to avoid attack by this disease trees of 20 to 30 years should be cut. European larch wood is appreciated for use as timber, for scaffolding, telegraph and telephone posts, and supports of all kinds. It keeps much better when in contact with soil than does Scotch pine.

*Map of the approximate geographical distribution of larches.*



1) *Larix occidentalis*.—2) *L. lyallii*.—3) *L. chinensis*.—4) *L. griffithii*.—5) *L. potanini*.—6) *L. leptolepis*.—7) *L. europaea*.—8) *L. europaea* × *leptolepis* (cultivated in England).—9) *L. polonica*.—10) *L. sibirica*.—11) *L. principis-Rupprechtii*.—12) *L. dahurica*.—13) *L. dahurica* × *sibirica*.—14) *L. olgensis*.—15) *L. kurensis*.—16) *L. cajanderi*.—17) *L. alaskensis*.—18) *L. americana*.—19) *L. americana* × *europaea* (cultivated in England).

Siberian larch is to be recommended for plantations in central and northern Sweden. Like the Scotch larch its trunk is high and straight. As it is equally subject to canker, the same care is necessary. Its wood has qualities similar to those of Scotch larch.

*Larix leptolepis* is a species suited to plantations in south Sweden. It grows rapidly in height and diameter, though the rate of growth begins to decrease at an earlier age than that of the two previous species. Although also attacked by canker, it bears shade better than the other larches. On

account of its thick top it is not suited to mixed stands, but only to those on good soil where a heavy production of wood is required in a short time. Its wood is less appreciated than that of the other larches.

*L. occidentalis* is comparable to the European and Siberian larches. Like them it is subject to canker. As it produces the best resinous wood in America, experimental plantations of it are recommended.

772 - **Forest Trees of the Argentine.** — *Revista forestal*, 1st. Year, No. 8, pp. 176, 179, 184; No. 10, pp. 243, 255, 260; No. 11, pp. 283, 292, 297; No. 12, pp. 335, 341, 345; 2nd Year, No. 15, pp. 449, 451; No. 17, pp. 499, 593, 597. Buenos-Aires, July, September, October, and November, 1917; January and February 1918.

Concise descriptions are given of the various uses to which the following trees may be put, with one or more plates of each.

"Espinillo aromita" (*Acacia Aroma* Gill. = *A. macracantha* Humb. and Bonpl.). Supplies fire wood and flowers from which a scent may be extracted.

"Iba-Jay" (*Eugenia edulis* Benth. Hook). Wood for cooperage, carpentry, joinery; tanning bark; flowers may be used for extracting scent; fruit may replace that of the tamarind.

"Iba Éé" (*Acanthosyris spinescens* Gr.). Wood for furniture making; fruit (nuts) gives a very alcoholic brandy; tree very ornamental and easily propagated.

"Espina de corona" (*Carugandra anorphoides*). Very compact and flexible wood for joinery. A Leguminosae all parts of which are rich in tannin. Bark, sap-wood and fruit rich in saponin, in which the fruit is especially rich, and used commercially to free hair, as well as woollen and silk materials, from fat.

"Aliso" (*Eupatorium* sp.). Compositae, very abundant on the banks of the Paraná and Paraguay, as well as on the islands and banks of the Bermejo. Wood white, light, used for field constructions and the manufacture of casks; suitable for paper-making.

"Guabiyú" (*Engelhardtia Guabiju* and *E. pungens*). Very fine joinery wood; bark, leaves and branches have tanning qualities; edible fruit.

"Sauce blanco" (*Salix Martiana* Leyb. = *S. Humboldiana* Willd.). Light wood used for making clogs and all light articles. Very abundant in moist soils. — "Sauce colorado" (*Salix Humboldiana*). Reaches a maximum height of 50 feet; requires less than two years to attain complete growth. Excellent wood for furniture making. Like the preceding tree it does well on moist soils and is excellent for making fibre and paper pulp.

"Urunday-urá" or "Urunday Blanco" (*Diplolepis floribunda*). Wood for furniture making.

"Trementina", or "Melle", or "Molle guazú" (*Ducana praecox* Griseb. = *Schinus pendens* Orteg.). Unlike the preceding trees which are all large, this Anacardiaceae is a bush; when incised it yields a resin; the leaves give an infusion used for the teeth; very fine pink wood.

"Toro-ratay", "Huñag", or "Palo cruz" (*Tabebuia nodosa*). Santalaceae, 26 to 33 feet high; yellow wood of which the handles of tools are made; used in dying.

"*Ivira pítá* (*Peltophorum Vogelianum* Benth.). Leguminosae with tanning bark; the pinkish-yellow wood, is used for cabinet-making, and more largely for making casks. "*Ivira-pítá-guazú*" (*Peltophorum rubium* = *P. Vogelianum*). A gigantic tree with hard, yellow wood; medicinal fruit, leaves, and roots.

"*Palo santo blanco*" (*Bulnesia Gancedit*), known as "*Guaiacum officinale*" in Brazil, where it was imported from Jamaica. In the Argentine it is found with the preceding species; fine, resistant wood of a dark green or blue; used for buildings or as fire wood; depurative infusions are made from it. The resin from the bark and sawings is used as a balsam.

"*Inga*" (*Inga affinis*). Large tree growing in moist soils; edible fruit; white wood not very resistant to inclement weather; the bark contains a fine red colouring matter and is used in tanning; by mixing an infusion of the bark with ferrous salts a blue-black ink is obtained.

773 - Swiss Forestry from 1914 to 1917. -- I. DECOUPET, M. (Chief Federal Inspector of Forests). Allgemeine Orientierung über die Holznutzungen in den Jahren 1914-1916. *Schweizerische Zeitschrift für Forstwesen*, Year LXVIII, No. 7-8, pp. 214-219. Berne, 1917. -- II. BAUDOUX, H., Notre Commerce de bois avec l'extérieur en 1916, in *Journal forestier suisse*, Year LXVIII, No. 7-8, pp. 129-133, *id.* -- III. BALSIGER, Die Holzschlagspolizei in den privaten Nächtschutzwaldungen nach dem Bundesratsbeschluss vom 23. Februar 1917, in *Schweizerische Zeitschrift für Forstwesen*, Year LXVIII, No. 9-10, pp. 237-244, *id.* -- IV. SCHÖNENBERGER, F., Betrachtungen zu der Schutzwaldfrage, *Ibid.*, pp. 245-249. -- V. HÉRIT. Réferat zur Motion Engeler, *Ibid.*, pp. 249-262. -- VI. BROLLEY, H., Rapport sur la "gestion directe", in *Journal forestier suisse*, Year LXVIII, No. 9-10, pp. 166-174, *id.* -- VII. BAUDOUX, H., Réunion de la Société suisse des forestiers, les 25 et 26 août, à Lümpenthal, *Ibid.*, pp. 181-188. -- VIII. Résolution pour la fourniture des bois de feu, *Ibid.*, p. 188. -- IX. TUSCHMANN, Die forstwirtschaftliche Zentralstelle, *Schweizerische Zeitschrift für Forstwesen*, Year LXVIII, No. 11, pp. 285-292, *id.* -- X. MURET, F. (Président de la Société des forestiers suisses), Rapport du Comité pour l'année 1916-1917, *Journal forestier suisse*, Year LXVIII, No. 11, pp. 293-297, *id.* -- XI. Rendement financier, en 1916, de quelques forêts communales à gestion technique, *Ibid.*, No. 12, p. 227.

According to a publication of the Chief Federal Inspector of Forests (a report read at a conference of delegates from the various federal departments and of Swiss forest inspectors) the influence of the war on Swiss forestry and forest industry has been very great. Before the war the wood production of Switzerland was insufficient for the requirements of the country and had to be supplemented by about  $\frac{1}{4}$  of the native production. In 1913 the difference between the exports and imports of wood was over 85 million cubic feet. In 1914 the imports still exceeded the exports by 3 %, but in 1915 the position was reversed and the exports were equal to the 1914 imports, and about double those of the year 1915. In 1916 the exports exceeded the imports by three times in quantity and four times in value. Italy and France received most of the wood exported, Germany only occupying the third place.

The excess of exportation of wood, the setting aside of certain quantities for yards, and the decreased coal supply which has necessitated the use of wood for gas-making, has led to an abnormal rise in price, and a certain shortage of fire-wood. The Government has had to take various special

measures — the fixation of maximum prices, permission for extraordinary felling of fire wood, and to exceed the felling provided for in the management of public forests, and cooperation in the work of utilisation. Moreover the export of certain wood-products has been forbidden and that of others regulated by special permits. At the same time the felling of walnut trees has been prohibited, the cutting of wood belonging to private individuals controlled, and the penalties for cutting wood in the lands under forest control increased.

The felling of trees in the public forests has not been excessive, but not a few privately owned young plantations not under forest control have been sacrificed. Thoughtless felling will result in a marked depression in wood production for many years.

On the whole the normal amount of wood cut in Switzerland amounts to over 7,431,270,000 cubic feet, whereas, in 1916, it rose to over 14,154,800,000 cubic feet. To prevent ultimate loss the regulations previously applied to controlled forests have been applied to the other forests, and it is possible that this control may be continued even after the war. On the other hand it is proposed to improve the conditions of forestry and utilisation of wood by increasing the public forests.

An important event was the meeting of the Association of Swiss Foresters (autumn of 1917), the chief object of which was to discuss the report of a Committee of action, nominated in 1911 with a view to improve both the position of Swiss foresters and the technique of forestry. The war has helped the attainment of this object because it has proved to the public the importance and economic value of forests.

The value of the Swiss forests, calculated on a 3 % yield, is over £ 58,000,000, or about the total of the debt for the federal railways at the end of 1915, whereas there are only 200 officials to administer the public forests, which have a minimum value of over £ 26,000,000. More recognition of the work of the forest officials and greater freedom for them in the management of the public forests are, therefore, demanded. A more technical and intensive management even of the private forests is also demanded, as this would mean a marked increase in the quantity and value of the wood per acre.

In support of this M. BIOLLEY gives data concerning a communal forest of 283 1/2 acres at an altitude of from 2,424 to 3,608 feet which had been devastated by successive fellings, neglect and destructive utilisation by its contractors. For 50 years this forest has been controlled. As a result during the last 25 years the amount of wood has been increased, and age, volume per tree and growth have been improved. Whereas it yielded 39.5 cubic feet per acre in 1891, in 1916 it yielded 103.6 cubic feet. As a result of good management the cutting even exceeded the estimated amount, reaching 115.3 cubic feet in 1916.

The chief demand of the meeting was for a revision of the forest legislation in force in Switzerland in order to extend the principle of forest control, even from an economic standpoint. As has been done by the Swiss Society of Timber Merchants, the Society of Swiss Foresters proposes to

form a central forestry office which will supply information, give commercial technical help, and undertake propaganda. With this aim in view two publications are being prepared which will be largely distributed; the object of one is to show the extent to which the yield of public and private forests may be increased, that of the other to show the work forestry demands from experts.

For 1916 the financial yield of some of the technically managed communal forests showed a marked increase, although this was not due to excessive felling. Thus a minimum of £ 1.15.0 per acre for the Bernese communal forests, corresponding to a utilisation of 97.1 cubic feet, rises to a maximum of £ 6.0.0 for the communal forests of St. Gall, corresponding to a utilisation of 154.2 cubic feet per acre. The cost of exploitation is not included in these estimates.

#### LIVE STOCK AND BREEDING.

774 — *Studies on Toxicity to Insects of Various Organic Compounds* — MOORE, WILLIAM; I. Toxicity of Various Benzene Derivatives to Insects; II. Volatility of Organic Compounds as an Index to the Toxicity of their Vapours to Insects, *Journal of Agricultural Research*, Vol. IX, No. 11, pp. 371-381 + Figs. Bibliography of 7 publications, and Vol. X, No. 7, pp. 365-371 Washington, June 11 and August 13, 1917.

I. — The author in a previous paper (1) pointed out the possibility of fumigating animals with nitrobenzene to destroy their external parasites. In that work and in later experiments with nitrobenzene as many as 500 animals (cattle, sheep, hogs, chickens, dogs, cats, rats, and guinea pigs) have been fumigated, with only two cases of possible poisoning. Nevertheless, in view of the extreme toxicity of nitrobenzene, it was felt that it might be too poisonous for general use. For this reason a study of 28 benzene derivatives was undertaken with a view to determining their toxicity to insects; and from the result of this study it was hoped that one or more compounds might be found which would be quite toxic to insects while non-toxic to higher animals or plants. A knowledge of the toxicity of the vapour of these compounds is valuable not alone for fumigation purposes but also as an index of their work as contact sprays, since SHAFER and, more recently, McINDOO have shown that most contact sprays kill by the action of their vapour rather than by the plugging of the spiracles.

One-liter Florence flasks of pyrex glass, closed with rubber stoppers coated with lead foil, were used as fumigation chambers. Measured quantities of the compound to be tested were placed on a piece of filter paper cut as small as possible, the paper was suspended from the stopper inside the flask, and the compound was allowed to evaporate. After several different insects were used in preliminary tests, the house fly (*Musca domestica*) was selected. Five flies were put into each flask, the chemical introduced, and the flask tightly stoppered. When all the flies in the flask were apparently dead, they were removed to a vial and given 24 hours to revive. If none revived, the time during which the flies were exposed to the vapour was recorded. But, if the flies revived, the experiment was repeated. In each case 5 tests were made.

(1) See the *Journal of Economic Entomology*, Vol. IX, No. 1, pp. 71-80, 2 Figs. 1916. (Ed.)

Since similar weights of the different chemicals do not contain the same number of molecules, and their toxicity could not, therefore, be accurately compared, it was decided to determine the toxicity in minutes for similar fractions of a gram-molecule of each chemical. Different quantities of each chemical were tested and curves plotted. As the quantities increased, it was found that each chemical had a point beyond which an increase would not give a reduction in the time required to kill. This is the point at which, the air is saturated with the vapour, and differs for each chemical. As the quantity is decreased, a point is reached where the vapour is not of sufficient strength to kill. The plotted curves lie between these two points.

After the curves were plotted, it was found to be impossible to compare similar fractions of a gram-molecule; hence, the different fractions of a gram-molecule necessary to kill in a fixed time of 400 minutes were determined. A long period of time was selected as a more nearly correct index of toxicity. The fraction of the gram-molecule was determined by dividing the amount of the chemical necessary to kill in 400 minutes, at a temperature of 70° F., by the molecular weight of the substance.

*Relation of the Volatility of Organic Compounds to their toxicity.*

Name of compound	Volatility in gram molecules evaporating in 400 minutes	Toxicity in millions of a gram molecule killing in 400 minutes	Name of compound	Volatility in gram molecules evaporating in 400 minutes	Toxicity in millions of a gram molecule killing in 400 minutes
Ethyl ether . . . . .	4.4245	4318.4	Amyl alcohol . . . . .	0.0460	38.2
Petroleum ether . . . . .	3.5841	713.3	Furfural . . . . .	0.0457	20.8
Ethyl mercaptan . . . . .	2.1541	109.9	Brommethyl-phenylketone . . . . .	0.0282	2.4
Methyl alcohol . . . . .	1.9776	671.8	Butyric acid . . . . .	0.0241	25.8
Acetone . . . . .	1.3631	954.3	Ethyl aceto acetate . . . . .	0.0192	24.8
Carbon bisulphide . . . . .	1.3616	286.3	Amyl valerate . . . . .	0.0182	11.2
Chloroform . . . . .	1.2870	804.6	Valeric acid . . . . .	0.0113	15.3
Carbon tetrachloride . . . . .	0.7067	161.9	Allyl isosulphocyanate . . . . .	0.0085	1.2
Ethyl alcohol . . . . .	0.4342	331.2	Nitrobenzene . . . . .	0.0058	1.8
Benzene . . . . .	0.4097	142.3	Ethyl malonate . . . . .	0.0054	9.6
Chloroform . . . . .	0.3243	1.7	Menthone . . . . .	0.0049	2.9
Acetic acid . . . . .	0.2936	60.0	Methyl salicylate . . . . .	0.0033	1.0
Thiophene . . . . .	0.2659	102.2	Camphene . . . . .	0.0032	44.0
Propyl acetate . . . . .	0.2610	103.4	Chloral hydrate . . . . .	0.0030	48.0
Acetaldehyde . . . . .	0.2343	27.3	Naphthalene . . . . .	0.0013	3.0
Toluene . . . . .	0.1918	147.5	Nicotine . . . . .	0.0010	2.4
Ethylene bromide . . . . .	0.1363	18.6	Camphor . . . . .	0.00068	5.2
Pyridine . . . . .	0.1347	21.7	Kerosene . . . . .	0.00067	11.0
Xylene . . . . .	0.1241	64.9	Chloretone . . . . .	0.0005	3.0
Amyl acetate . . . . .	0.0627	44.8	Menthol . . . . .	0.00019	3.2
Gasoline . . . . .	0.0520	42.0	Thymol . . . . .	0.00014	0.0
Amyl nitrite . . . . .	0.0512	41.1	Brometone . . . . .	0.00009	1.1
Bromoform . . . . .	0.0486	7.7			

All the benzene derivatives tested proved to be more toxic to insects, molecule for molecule, than carbon bisulphide.

Physical characters, such as boiling point and vapour pressure, have more influence on the toxicity than chemical composition.

Up to 250° C. the higher the boiling point the more toxic the compound to insects. Beyonds 250° C. the compound is usually so slightly volatile that not enough of the chemical will evaporate to be effective.

Lipoids are very soluble in compounds with low boiling points and but slightly soluble in compounds with high boiling points.

Compounds with low boiling points, although less toxic, owing to their great volatility, may give better results than compounds with high boiling points, particularly in the fumigation of grain.

The toxicity of the benzene derivatives was found to be similar for other insects. A comparison of the bluebottle fly (*Lucilia sericata*) with the house fly shows that house flies die more quickly from compounds with a low boiling point than bluebottle flies, while compounds with a high boiling point are more toxic to the bluebottle flies than to the house fly. Similarly, the cockroach (*Blattella germanica*) succumbs less readily than the potato beetle (*Leptinotarsa decemlineata*) to low boiling compounds and more readily to high boiling compounds. This relationship may be due to morphological differences in the insects, possibly the diameter of the spiracles or trachea.

For the fumigation of animals a compound with a high boiling point is needed in order that relatively little of the material shall be in the air to be taken in by the animal or to irritate the eyes or nose. In this respect salicylic aldehyde is probably the best. The cost of this chemical is prohibitive for general fumigation; but, inasmuch as higher animals readily oxidize it to salicylic acid, which is very slightly poisonous, this compound might be used for the internal fumigation of horses to destroy bots as carbon bisulphide is now used.

II. -- Having pointed out the relationship between the toxicity of various benzene derivatives and their boiling points, the question arose whether a similar relationship of boiling point and toxicity existed among other-volatile organic compounds. Early in the work it was discovered that boiling point was merely a convenient general index of the volatility of the compound and that the real relationship was probably between toxicity and volatility. It was at first thought that this relationship existed only with compounds having an action on lower organisms similar to that of chloroform and ether, but it was soon found to have a wider range of application.

In general, the same methods were employed as in the previous work. The results are given in the table on p. 835 and summarised as follows:

In general, the toxicity of a volatile organic compound is correlated closely with its volatility. A decreasing volatility is accompanied by an increased toxicity. The boiling point of the chemical is a general index of its volatility. Compounds with boiling points of 225° to 250° C. are usually so slightly volatile that they do not produce death except after very long exposures. The structure of the respiratory system of the insect is probably

responsible for the remarkable influence of volatility on the toxicity of the vapour of volatile organic compounds.

775 - **Observations on the Immunity to Rinderpest of the Nellore (Indian) Cattle and of the Nellore-Native Grade Crosses, in the Philippines.** — YOUNGBERG, STANTON (Chief Veterinarian), in *The Philippine Agricultural Review*, Vol. X, No. 4, pp. 436-447, 6 Diagr., Bibliography of 6 Publications. Manila, 1917.

During the year 1909 the Philippine Bureau of Agriculture purchased 103 head of first-class Nellore cattle, with the purpose of ascertaining if these cattle could readily adapt themselves to local condition, and if they could be used to improve the native breeds of cattle. It was found that the Nellore cattle readily adapted themselves to the conditions in the lower altitudes of the Philippine Islands and that the crosses upon native and Chinese dams produced a very good type of animal.

Since 1909 further introductions of Nellore cattle have been made from time to time, and they are now being used to a great extent throughout the Islands for improving the native stock. The high resistance to rinderpest of the "plains" cattle of India has long been recognized (1). Coincident with the extended use of Nellore cattle for breeding purposes in the Philippines the idea became disseminated that the grades were very highly resistant to rinderpest and that by importing cattle of Indian breeds and crossing them upon the native stock the rinderpest problem would be solved. In view of this, the author decided to test the resistance of pure-bred Nellore cattle to the Philippine strain of rinderpest and also to make more careful tests and observations in regard to the resistance of the Nellore native grades. The results led to the following conclusions: . . . The pure Nellore cattle are very highly resistant to the Philippine strains of rinderpest, the mortality being insignificant. They are not, however, absolutely immune.

In the case of native cattle, the infectivity of the virus is not appreciably attenuated by being passed through Nellore cattle. This fact makes the latter very dangerous as conveyors of the disease, as they may react without showing clinical evidence.

The half-bred Nellore-native cattle do not inherit the high degree of resistance to rinderpest possessed by the Nellore stock. In infections of moderate virulence they apparently have somewhat greater resistance than the native animals, but in virulent infections this resistance does not afford them any protection.

(1) LINGARD, ALFRED (*Report on the Preparation of Rinderpest Protective Serum*, Calcutta, 1901, p. 8) states that "The cattle and buffaloes of the plains show varying degrees of immunity, so much so that especially in the United Provinces it would be impossible to utilize them for supplying virulent blood or for the purpose of testing the protective value of sera where a marked susceptibility is necessary in the animals utilized. Further it is well known that some plains animals in this country may pass through attacks of rinderpest of so slight a character, that it may even be overlooked by the initiated in this disease". He also ascertained that these plains cattle "require a dose (of serum) 15 to 18 times less than that required by the small bill animals per 600 pounds body weight". Similar statements have been made by HOLMES, J. D. E. (*Indian Civil Veterinary Department, Memoir No. 3*, p. 127; *Memoirs of the Department of Agriculture in India, Veterinary Series*, Vol. II, No. 2, p. 42). (Author)

From the inconclusive evidence at hand, the three-fourths Nellore-native grades appear to have a greater resistance than the native stock. The rinderpest problem of the Philippine Islands cannot be solved by the importation of Nellore or other Indian Cattle, unless possibly by carrying it out to the extent of practically eliminating the native stock.

776 - **Official Measures Adopted in the Argentine for the Control of the Tick Transmitt-ing "Tristeza".** — *Annales de la Sociedad Rural Argentina*, Vol. LI, No 2, pp. 124-125. Buenos Aires, March-April, 1917.

The Argentine Government, acting upon the advice of the Ministry of Agriculture and upon information furnished by various agricultural societies, issued a decree in April, 1917, for the purposes of 1) calling attention to the losses caused by ticks, 2) pointing out the necessity for vigorous sanitary action, and 3) authorising the application of the measures suggested by a Commission appointed by the Ministry of Agriculture in October, 1916, if considered suitable by the Live Stock Department.

The decree defines the limits of certain areas as tick-free, intermediate or infested. Very strict rules are laid down regarding the movement of cattle from one area to another; these will be enforced two years after the date of the decree. Cattle may be moved from unclassified establishments only after preliminary dipping and then only within their own defined area. Official dipping tanks will be installed in the larger cattle markets and wherever considered necessary throughout the intermediate and infested areas. Corrals are to be set apart for the temporary housing of tick-free cattle journeying from the north. The best insecticides for tick eradication will be obtained and exact instructions issued for their application in varying proportions throughout the different seasons, as well as practical instructions for dipping. The biology of the tick (*Margaropus annulatus*) and methods for its destruction are to be studied under direction of the Ministry of Agriculture, and only competent inspectors will be chosen to superintend the dipping-tanks. All expenses in connection with tick treatment will be reduced to a minimum.

777 - **Pathogenic Action of Ixodids.** — PARODI, SILVIO E., in *Annales de la Sociedad Rural Argentina*, Vol. LI, No 2, pp. 121-124 + 4 Pigs. Buenos Aires, March-April, 1917.

This paper is a review of the subject of tick-infestation, and gives an account of the various parasites transmitted by Ixodids and of their evolution in the tick and in the animal host. The method of transmission from tick to host is described. The ticks dealt with include *Margaropus annulatus*, which transmits *Piroplasma bigeminum* and *Anaplasma marginale* as well as *Theileria* and *Nuttallia* (these last two blood protozoa have not hitherto been observed in the Argentine). The author records his own experiences in the investigation of the evolution of the parasite in the tick.

In the tubes of the salivary glands and, more rarely, in the ovarian glands of the females of *M. annulatus* he found filiform forms of the parasite, which might be defined as sporozoites. In the stomach glands he found oval forms, besides other more or less spherical ones, which he identified as more

developed forms (sporoblasts) than the former, and, consequently, consecutive.

While studying the transmission of *Anaplasma* he came to the conclusion that *Stomoxys* and Tabanids do not transmit this disease. Healthy animals placed with those infected, but freed from ticks, remained uninfected although they were attacked by these flies.

In the case of natural or spontaneous anaplasmosis the disease is always preceded by piroplasmosis. Several authors, chiefly DESCAZEAU and PICOLLO, maintain that the piroplasms, through the meganaplasma (spherical mass of chromatin 2 to 3  $\mu$  in diameter) phase change into anaplasms, and these in their turn may change into secondary piroplasms. The author inoculated a cow at the same time with *Piroplasma* and *Anaplasma*, and observed that the two parasites always preserve their characteristic morphological conformation.

**778 - Thyroid Hyperplasia and the Relation of Iodine to the Hairless Pig Malady (1).**

— HAKT, E. B. and STEENBOCK, H., in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 2, pp. 313-323 + 2 Plates, Baltimore, Md., February, 1918.

The writers' experience with the hairless pig malady supports the view that it is occasioned by a low iodine assimilation by either intestine or thyroid, resulting in a goitrous condition in both mother and young. This condition interferes more severely with foetal development than with the normal maintenance of the mother. It appears to be produced by rations with high protein levels and low laxative effects, with the accompanying condition of lack of exercise and unclean surroundings. Young sows exposed to such conditions are more prone to develop thyroid enlargement than are mature sows. The authors recognize that there is the possibility that some rations from certain regions are naturally so low in iodine as to make the scarcity of iodine the direct cause. They have found it possible to grow sows to maturity on natural feeding materials grown in southern Wisconsin, but of relatively low protein content and good laxative properties, with the production of normal offspring. On the other hand, these same feeds combined in different proportions and fortified with protein concentrates lead to the production of hairless pigs.

The authors are of the opinion, for the present at least, that they have not reached the stage where it is wise to advocate the general use of iodine in the feed of all brood sows; that the conditions leading to the production of hairless pigs should first be analysed fully in order that we may acquire a complete understanding of the reasons for the successful rearing of sows intended for breeding purposes through the use of natural materials, unfortified with potassium iodide. However, in regions and on farms where hairless pig production is endemic or persistent in character the direct use of iodides should be made.

**779 - Poultry Parasites.** — HADLINGTON, J., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, No. 9, pp. 671-673, Sydney, September 3, 1917.

Vermi in poultry houses naturally fall into two groups: parasites that

(1) See also *R.* March 1918, No. 305 (F.I.).

live and hibernate in the poultry house on roofs, etc., such as *Dermanyssus gallinae* (red mite), and those which pass their whole existence on the fowl, such as *Goniocotes abdominalis* (large chicken louse). The latter may be combated with a dust bath, or by dusting the birds by hand with insecticides, or sulphur, or with equal parts of sulphur and fine ashes. The best method of keeping poultry houses free from vermin is to spray them with kerosene emulsion as often as necessary. The emulsion, which should be applied by a force pump so as to reach all the cracks and crevices, is composed of 8 oz. soft soap dissolved in 1 gal. boiling water, 1 gal. of kerosene being slowly added while stirring, and the whole thoroughly shaken to effect emulsification. For use, 10 gals. soft water must be added, and if the spray is to be also a disinfectant, one table spoonful of miscible carbolic acid to each gallon of emulsion should be stirred in. Where the infestation is severe, 2 or 3 applications may be necessary at intervals of 1 or 2 days.

780 — **Infections Caused by *Bacterium pullorum* in Adult Fowls** (1). — HADLEY, Puter, assisted by CALDWELL, D. W., ELKINS, M. W. and J. AMBERT, D. J., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin 172*, 10 pp., 11 Tables. Bibliography of 13 Publications. Kingston, R. I., November, 1917.

The present paper gives the results of a study in which it was established that *Bact. pullorum* Rettger was the causal agent in an epidemic in adult fowls indistinguishable in its clinical picture and pathological manifestations from fowl typhoid. The primary observations and the experimental features of the study lead to the conclusion that latent *Bact. pullorum* infection was stimulated into active manifestations of fatal generalised infection as a result of intestinal irritation, or other physiological changes, following the feeding of a ration containing a large proportion of roughage in the form of oat husks. The authors point out the need of regarding more seriously the *endogenous* as opposed to the *exogenous* origin of "epidemic" diseases among poultry. Among possible endogenous disease-stimuli the importance of a hygienic feeding diet is especially emphasized. The existence of intermediate bacterial forms, resembling *Bact. pullorum* but varying slightly toward *B. gallinarum* is suggested, and it is proposed to make use of the terms *Bact. pullorum* A. and *Bact. pullorum* B. in order to keep these types distinct pending their further study. It is further suggested that *Bact. pullorum* appears to stand as a border-line group in the colon-typhoid intermediates, separating the actual paratyphoids (*B. gallinarum*, etc.) from the actual paracolons (*B. suis*, *B. paratyphosus* A and B, etc.).

781 — **Studies in Calcium and Magnesium Metabolism** . . . J. GIVENS, M. H. and MENDEL, LAFAYETTE B., The Effects of Base and Acid; II. GIVENS, M. H., The Effect of Diets Poor in Calcium: III. GIVENS, M. H., The Effect of Fat and Fatty Acid Derivatives, — *The Journal of Biological Chemistry*, Vol. XXXI, No. 2, pp. 121-123. Bibliography of 19 Publications; pp. 133-139. Bibl. of 15 Publ.; pp. 444-445. Bibl. of 6 Publ. Baltimore, Md., August 1-17.

The work described was carried out at the Sheffield Laboratory of Physiological Chemistry, Yale University, New Haven.

(1) See also *R*, Febr. 1918, No. 150, (Ed.)

I. — The present investigation is primarily the outcome of a consideration of a claim of Dubois and Storke (*Jahrbuch für Kinderheilkunde*, Vol. LXXII, p. 21, 1913) that storage of calcium is dependent upon a suitable supply of alkali so the organism. By the addition of alkali carbonates to the food of children these investigators found that they could change a negative calcium balance to a positive one. They believed this outcome to be due to the neutralization, by the alkali, of the phosphoric and sulphuric acids formed in metabolism; also to a prevention of the formation in the alimentary canal of insoluble calcium soaps which cannot be utilized. According to the first consideration, by supplying alkali the unnecessary withdrawal of calcium as a neutralising agent for acids formed in metabolism is averted; and in the second instance the loss of unabsorbed calcium by the bowel is prevented.

The general plan of the studies of the authors involves metabolism experiments carried out with dogs, in which the income and outgo and the corresponding balance of various elements were ascertained under diverse conditions of diet. The results arrived at were as follows:—

Administration of base or acid produced no significant effect upon the balance of nitrogen, calcium, magnesium, and phosphorus in the dog.

Administration of hydrochloric acid increased the urinary excretion of calcium and thereby altered the relation of calcium to magnesium in the urine.

The calcium contained in milk was more effective than soluble calcium lactate in producing calcium retention.

Administration of large doses of alkali bicarbonate to a human diabetic did not decrease the urinary output of calcium.

II. — From a summary, given by the author in tabulated form, of all the available literature on the urinary alkali-earth excretion of *adult* dogs it is evident that there exists no *definite* relation between the diets and urinary calcium and magnesium. The tendency is for the excretion of these elements to increase as the intake of them increase.

From the literature on the subject we are led to conclude that a diet poor in calcium is not conducive to a storage of either calcium or magnesium, despite an abundance of nitrogenous food. This is further established by the author's investigations.

III. — The present conception of the digestion and utilisation of fats and other comparable esters of fatty acid would lead one to expect that if they are hydrolysed in the normally functioning alimentary tract the resulting fatty acid will either be absorbed promptly or excreted as insoluble soap with faeces. The extent to which absorption occurs may therefore depend not only upon the digestion of the esters but also upon the degree to which alkali earths are simultaneously present in the intestine to render the fatty acids insoluble and unutilizable. Conversely the loss of alkali earths through the bowel may likewise be promoted by the presence of large quantities of fatty acids. A study of the data here presented shows, with respect to the deportment of the calcium, that when the utilization is poor the loss of calcium is proportionate larger.

Similarly the negative calcium balance was smaller in those cases where the utilization of the fat was more satisfactory.

Although the quantity of calcium fed as calcium lactate in one of the periods was undoubtedly sufficient to induce a storage of lime on the basal diet this could not be accomplished when the fat utilisation was poor.

It is evident from the data presented that poor utilization of fats or fatty acids may increase the excretion of lime in the faeces and prevent the storage of calcium even when the calcium intake is comparatively abundant.

782 - The Nutritive Properties of Maize (1). — HOGAN, ALBERT A. (Department of Chemistry, Kansas State Agricultural Experiment Station, Manhattan, Kansas), in *The Journal of Biological Chemistry*, Vol. XXVII, No. 1, pp. 193-208, Bibliography of 21 Publications, Baltimore, Md., 1916.

The nutritive deficiencies of maize have been ascribed by the different investigators to : its lack of certain inorganic constituents ; protein deficiencies ; too small quantities of vitamines.

Most of the data described in this report were obtained by using albino rats as experimental animals. Some of them were given maize alone, others maize plus a salt mixture, a third lot maize plus an "ash-free" protein and a fourth maize plus "ash free" protein plus a salt mixture. The results are summarised as follows : —

The evidence indicates that when maize is fed to rats as the sole dietary the mineral constituents are the first limiting factor, and then the protein. In the case of swine these findings are apparently reversed. Protein is here the first limiting factor, and then the mineral element. The data also indicate that the maize proteins are less efficient for growth than casein. The addition of lysine and tryptophane to maize did not increase its efficiency for growth. The addition of some of the adequate proteins (egg white) seemed of only slight benefit. In view of these facts it seems possible that one of the limiting factors in maize as a food for growing rats is one or more of the growth accessories.

Young rats on a maize diet grow more rapidly when the grain is supplemented with casein than when supplemented with egg white. This observation assumes added significance since food mixtures containing protein free milk, butter, and egg white are more efficient for growth than mixtures of maize and egg white, even though the protein of the maize mixture furnishes a relatively higher per cent of calories than does the protein of the more efficient diet.

Autoclaved maize mixtures failed to maintain body weight and ultimate failure resulted.

Since swine grow rapidly on a mixture of maize and egg white, it is believed that maize contains sufficient of the growth accessories for normal growth in swine.

(1) See also *R.* February 1918, No. 186. (*Ed.*)

783 - **Sudan Grass Silage.** — FRANCIS, C. K. and FRIEDEMANN, W. S., in the *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station Bulletin*, No. 115, Stillwater, Oklahoma, April 1917.

The department of chemistry of the Oklahoma Agricultural Experiment Station is engaged in investigating silage as prepared from the grain sorghums and closely related crops. A part of this experiment involves considerable work with sudan grass, and, owing to the apparent excellent quality of the silage, some of the results of this experiment have been published by the investigators in this bulletin. A steel silo 25 feet high and 9 feet wide, approximate capacity 75 tons, was used for curing the crop. The sudan grass was cut early in August during a dry period so that the plants did not contain as much moisture as desired. The sudan grass was cut to a three-quarter-inch length and a small stream of water was kept flowing into the blower, thus distributing the added water throughout the material as it was placed in the silo. During the filling of the silo the material was packed by three men tramping it into place as solidly as possible. The sudan grass owing to its leafy nature and dry condition did not pack readily. The day after the silo had been filled, water was added at the top until it ran out at the two-foot level. Three days later the contents of the silo had settled several inches and this place was filled with additional wetted silage to serve as cover. This material did not cure well, and was discarded when a strong mouldy condition developed, but the silage just beneath it cured nicely and retained its flavour throughout the feeding period. The composition of sudan grass silage as compared with maize silage is shown in Table I. The length of time which the material remained in the silo is indicated in the first column as days.

TABLE I.—*Percentage Composition of Sudan Grass Silage and Maize Silage (water-free basis).*

	Ash	Protein	Carbohydrates		Fat	Dry matter
			Fibre	N free extract		
Sudan grass silage fresh . . . . .	7.21	9.38	30.55	50.53	2.33	40.47
Maize silage fresh . . . . .	6.58	8.30	23.39	50.45	2.16	30.49
Sudan grass silage near top, 122 days .	5.60	6.20	33.53	50.50	2.17	27.74
Maize silage near top, 148 days . . . .	6.81	9.56	23.62	57.41	2.60	27.75
Sudan grass silage from middle, 140 days .	7.51	10.36	33.57	46.79	2.77	27.24
Sudan grass silage from middle, 182 days .	6.20	8.85	22.84	59.15	2.96	27.44
Sudan grass silage 2 feet above bottom, 283 days . . . . .	5.15	8.33	34.69	49.11	2.72	24.29
Spoiled sudan grass silage 2 foot-level, 162 days . . . . .	8.05	10.94	29.05	48.82	2.23	24.28

There is on the whole but little difference in the analyses of the maize silage and the sudan grass silage at the several stages of curing, the principal difference being in the quantity of fibre. The temperature developed in

the silo was noted at regular intervals until a decided fall was observed. From the data presented it appears that the maximum temperature was reached in about 21 to 30 days, being respectively 120° F. for the top portion, 104° F. for the middle portion, 21 feet from top, and 98.5° F. for the portion 5 feet from bottom.

The total quantity spoiled in this silo was approximately four feet, being the covering material. The sudangrass silage was somewhat bulkier than maize silage, was a light brown colour and had a faint acid odour. No alcohols were detected by the usual laboratory methods. The silage was fed to the College sheep, and, while proving a good feed, it did not appear to be relished by the animals so well as the maize silage, but quite as well as that made from other grain sorghums, and was relished much more in this form than as cured hay.

**784 - Nutrition Investigations upon Cottonseed Meal and Cottonseed Flour.** — RICHARDSON, ANNA E. and GREEN, HELEN S. Nutrition Research Laboratory, Department of Domestic Economy, The University of Texas, Austin, in *The Journal of Biological Chemistry*, Vol. XXV, No. 2, pp. 317-328, 5 Diagr. Baltimore, Md., June, 1916; Vol. XXX, No. 2 pp. 243-258, 13 Diagr. June, 1917; Vol. XXXI, No. 2, pp. 379-388, 4 Diagr. August, 1917

I. — In this paper the authors present a preliminary report on the efficiency of cottonseed meal as a food for promoting the growth, development and reproduction of the albino rat.

The results indicate that cottonseed meal does not contain sufficient mineral for growth, is not actively toxic, contains efficient protein, and perhaps fat-soluble growth-promoting substance, similar to those of butterfat, but in less adequate quantities.

II. — Albino rats have lived for 400 to 565 days with 50 per cent cottonseed flour in the diet.

The protein in a diet containing 50 per cent cottonseed flour, protein-free milk, and butterfat is sufficient for the normal growth and development of the albino rat and for reproduction to the third generation. No better growth is induced, but more frequent reproduction with lower mortality and more general well-being of animals are obtained, by the addition of 5 per cent casein to a diet containing 50 per cent cottonseed flour, butterfat, and protein-free milk.

Normal growth and reproduction do not result from diets containing 50 per cent cottonseed flour in which there is a lack of butter fat, protein-free milk, or both. However, 50 per cent cottonseed flour with 5 per cent casein and butter fat, without additional mineral beside that furnished by the cottonseed flour, supports normal growth and reproduction although the second generation does not grow quite normally on this diet.

No toxic effect is apparent in feeding from 45 to 50 per cent cottonseed flour to albino rats through four successive generations or during 565 days of the life of an individual. Petroleum-ether extract of the entire cottonseed fed in a well balanced diet has a depressing influence on the weight of the albino rat. Ethyl ether extract from petroleum-ether-extracted cottonseed and ethyl ether extract of Allison cottonseed flour have no harmful effect upon the albino rat.

III. — This paper considers the content in cottonseed flour of growth-essential factor other than protein and mineral, and reports the results of studies of the protein minimum of cottonseed flour. The results are summarised as follows : —

1) 20 per cent of the water extract of cottonseed flour dried on starch, equivalent per gm. to 2.5 gm. of cottonseed flour, *i. e.*, 50 per cent cottonseed flour in the diet, contains sufficient water-soluble food accessory for normal growth.

2) 4.35 per cent of the ether extract of cottonseed flour equivalent per gm. to 11.5 gm. of cottonseed flour, *i. e.*, 50 per cent cottonseed flour in the diet, does not contain sufficient fat-soluble food accessory for normal growth, but 12 per cent of the ether extract appears quite as efficient in supplying enough of the fat soluble accessory for normal growth as does an equivalent amount of butter fat.

3) 18 per cent cottonseed protein when supplied with adequate amounts of all other necessary nutritive factors induces practically normal growth of the male rat, and better than average growth in the female, and fairly normal reproduction, with high mortality and under size among the second generation.

4) 12 per cent cottonseed protein does not induce perfectly normal growth.

Very little growth has been obtained with 6 per cent protein, the average gain in weight during 12.8 days being 8 to 9 gm. With only 4 per cent cottonseed protein rats have fallen off in weight when first placed upon this diet but have almost successfully maintained their weight for 50 days after.

785 — **Food Value of the Pea Nut (*Arachis hypogaea*)** (1). — DANIELS, AMY L. and LOUGHIN, ROSEMARY (University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 2, pp. 295-301 + 3 Diagrams. Baltimore, February, 1918.

Up to the present the pea nut has been used chiefly as a cattle feed with such excellent results that the authors undertook a study to determine more exactly its food value. Feeding experiments on young rats showed the pea nut to be lacking in McCollum's fat-soluble food accessory. When 2% of butter fat was added to the ration the subjects improved, and with 5% showed absolutely normal appearance and development in every way. This, moreover, proves that the pea nut contains a sufficient quantity of McCollum's water soluble food accessory, as 56% of pea nut in the ration suffices to supply the necessary quantity of this accessory.

If the pea nut is compared with the soya bean (2) it is found to be poorer in mineral matter, especially in calcium, potassium, magnesium and sulphur. If a pea nut ration be completed by the minerals necessary to give it a mineral content equal to that of milk, which has been shown to be adequate for growing animals, a suitable food is obtained. Pea nut meal, which contains a large proportion of hulls, seems to contain sufficient mineral matter to maintain normal growth in young animals if 5% of butter fat be added.

In view of the large acreage suitable to the cultivation of the pea nut

(1) See also *R. March*, 1917, No. 268. (2) *S. C. R. January*, 1918, No. 4. *E.d.*

and the fact that there is a tendency to use considerably more plant seeds in the diet, the authors do not hesitate to suggest the use of the pea nut as a human foodstuff. As in the case of the soya bean it is only necessary to add to it those elements in which it is lacking, *i. e.* certain inorganic material and the fat-soluble food accessory, to make it a complete food.

**786 — Potato Peelings and Heather as Coarse Fodder for Horses; Researches in Holland.**

— VAN DRIEST, P. A., in the *Tydskrif voor Diergeneskunde*, Part 45, No. 10, pp. 286-288. The Hague, May, 1918.

**POTATO PEELINGS.** — According to the author, these constitute an excellent coarse feed for horses. Chemical analysis shows that washed and finely chopped peelings contain 12 % of starch, 1.27 % of albuminoids and 83.4 % of water. Although, according to SJOLLEMA the albuminoids in the peelings are of good feeding value and digestibility, the peelings are principally a starchy food.

As regards solanin, the author found that of 2 samples of peelings, one raw, the other having been boiled for 12 minutes, on analysis by the Meyer method the first was found to contain 80.4 % of water and 0.016 % of solanin, and the second, 90 % of water and 0.006 % of solanin. The increased water content, therefore, results in a reduced solanin content. Further the author has found that solanin is almost completely soluble in boiling water containing a very small amount of vinegar. Therefore, he advises, so as to avoid entirely the bad effect of solanin, that the peelings should be cooked for 10 to 15 minutes in water containing a little vinegar, then immediately removed as, on cooling, the solanin might be precipitated and be deposited again on the peelings.

Cooking the peelings has the advantage that their relatively high potash content, which is supposed to produce bad effects, is considerably reduced. In fact, the author found that a sample of raw peelings contained 1.14 % of ash, while after cooking there was only 0.58 %. As potassium compounds are mostly soluble, it may be admitted that in this way the greater part of the potassium is removed.

**HEATHER.** — To determine its feeding value, 2 pairs of draught horses were used that gave the same amount of work. The first team received each day 6.6 lb. of heather over and above the normal ration; the second team served as control. The animals were weighed every 2 days; the heather did not in any way influence the increase in live weight of the animals.

**787 — A Study of the Rate and Economy of Gains of Fattening Steers.** — MUMFORD, H. W., GRINDLEY, H. S., EMMETT, A. D. and BULL, S., in *University of Illinois Agricultural Experiment Station, Bulletin No. 197*, pp. 567-604. Urbana, Illinois, March, 1917.

This bulletin is one of a series reporting the findings of an investigation in regard to the effect of variations in the amount and character of feed consumed upon the nutrition of two-year-old steers. It gives the results relating to the effect upon the rate and economy of gains: — 1) of variations in the amount of feed consumed ranging from maintenance to full feed rations; 2) of variations in the proportions of roughage and con-

centrates in the ration; and 3) of the substitution of a nitrogenous concentrate for a part of the grain of a ration of clover hay and ground maize in the ratio of 1 to 5.

*The Experiment.* — Sixteen two-year-old, choice feeder steers were divided into 4 lots of 4 steers each. One lot was given a ration slightly above maintenance, another, an amount of feed equal to the maintenance ration plus one-third of the difference between the maintenance and the full-feed rations, another, an amount equal to the maintenance ration plus two-thirds of the difference between the maintenance and the full-feed rations, and another as much feed as the steers would eat readily.

The experiment lasted for 27 weeks and was divided into five test periods. The first period was 5 weeks in length, the second, third and fourth were each 6 weeks in length and the fifth was 4 weeks in length.

The feeds used were clover hay, ground maize, and linseed oil meal. The ration of the first test period consisted of clover hay and ground maize in the ratio of 1:1, that of the second, of clover hay and ground maize in the ratio of 1:3, that of the third, of clover hay and ground maize in the ratio of 1:5, and that of the fourth and fifth of clover hay, ground maize, and linseed oil meal in the ratio of 1:4:1.

In periods 1, 2, 3, 4, 5, the average daily gains of the different lots and the individual variations were as shown in Table I:

	Lot	Average daily gains	Variations in daily gains	
			lb.	lb.
Period 1	Maintenance . . . . .	1.46	0.34 - 1.97	
	One-third-feed . . . . .	2.08	1.69 - 2.51	
	Two-thirds-feed . . . . .	2.87	2.51 - 3.37	
	Full-feed . . . . .	2.98	2.54 - 3.40	
Period 2	Maintenance . . . . .	0.00	- 0.12 - 0.07	
	One-third-feed . . . . .	1.04	1.31 - 1.98	
	Two-thirds-feed . . . . .	1.84	1.57 - 2.24	
	Full-feed . . . . .	2.28	1.95 - 2.62	
Period 3	Maintenance . . . . .	0.04	- 0.12 - 0.14	
	One-third-feed . . . . .	1.12	0.55 - 1.10	
	Two-thirds-feed . . . . .	1.48	1.02 - 1.74	
	Full-feed . . . . .	1.50	0.90 - 2.12	
Period 4	Maintenance . . . . .	0.85	0.74 - 0.95	
	One-third-feed . . . . .	1.65	1.36 - 2.17	
	Two-thirds-feed . . . . .	2.14	1.74 - 3.07	
	Full-feed . . . . .	2.45	1.81 - 2.86	
Average of the 4 periods	Maintenance . . . . .	0.70	0.37 - 1.05	
	One-third-feed . . . . .	1.32	1.23 - 1.39	
	Two-thirds feed . . . . .	1.79	1.75 - 1.81	
	Full-feed . . . . .	2.13	1.98 - 2.29	

The consumption of dry substance, digestible dry substance and net energy per pound of gain by one-third, two-third and full feed lots in the 5 periods was as shown in Table II.

Lot	Dry substance per lb. of gain		Digestible dry substance per lb. of gain		Net energy per lb. of gain	
	Average		Average		Average	
	lb.	lb.	lb.	lb.	lb.	lb.
Period 1	One-third-feed . . .	6.61 5.35- 8.17	4.36 3.68- 5.38	4.12 3.50- 5.09		
	Two-thirds-feed . . .	6.25 5.37- 7.21	3.91 4.41- 4.63	3.76 3.21- 4.34		
	Full-feed . . . . .	7.33 6.02- 8.71	4.59 3.82- 5.40	4.32 3.61- 5.06		
Period 2	One-third-feed . . .	7.95 6.57-10.12	5.71 4.73- 7.20	5.90 4.88- 7.45		
	Two-thirds-feed . . .	9.06 7.78-11.85	6.85 5.40- 8.09	7.05 5.54- 8.33		
	Full-feed . . . . .	9.86 8.27-12.00	6.36 5.35- 7.24	6.51 5.47- 7.40		
Period 3	One-third-feed . . .	10.40 8.05-20.30	7.91 6.10-15.24	8.46 6.53-16.33		
	Two-thirds-feed . . .	11.08 9.70-16.47	8.15 7.14-11.71	8.72 7.03-12.53		
	Full-feed . . . . .	12.41 7.64-20.16	8.03 6.66-13.16	9.08 6.04-13.65		
Period 4	One-third-feed . . .	6.81 5.18- 7.78	5.24 3.95- 6.04	5.53 4.20- 6.38		
	Two-thirds-feed . . .	7.06 5.11- 8.28	5.30 3.83- 6.22	5.58 4.94- 6.55		
	Full-feed . . . . .	7.64 6.94- 8.22	5.79 5.50- 6.50	6.15 5.56- 6.87		
Average of the 4 Periods		9.51 9.17-10.04	6.96 6.73- 7.29	7.22 6.97- 7.55		
Two-thirds-feed . . .		9.49 8.95- 9.04	6.67 6.48- 6.86	6.90 6.67- 7.10		
Full-feed . . . . .		9.63 8.41-10.47	6.60 5.95- 7.23	6.73 6.10- 7.48		

From these results the following conclusions were drawn: —

Two-year-old steers may be maintained on 8 to 9 lb. of dry substance, 0.39 to 0.44 lb. of digestible crude protein and 6.5 to 6.8 calories of net energy per 1000 pounds live weight.

Fattening two-year-old steers may make satisfactory gains over a period of twenty-seven weeks on 14.3 to 22.1 lb. of dry substance, 0.72 to 1.44 lb. of digestible crude protein, and 11.9 to 13.0 calories of net energy per 1000 pounds live weight. Fairly good gains may be made even on less amounts than these.

The rate of gains of two-year-old steers depends upon the amount of feed consumed. However, the amount of feed consumed between one-third feed and full feed apparently has no effect upon the economy of gains as measured by the consumption of feed, of total dry substance, of digestible dry substance, and of net energy per pound of gain.

When a ration consisting of clover hay and ground maize in equal parts is changed to a ration consisting of one part of clover hay and three parts of corn, the amounts of digestible dry substance and net energy remaining practically unchanged, but the protein being reduced 10 to 12 per cent, the rate of gains and the economy of gains are considerably decreased. When a

ration consisting of one part of clover hay and three parts of ground maize is changed to one consisting of one part of clover hay and five parts of ground maize, the digestible dry substance, digestible protein and net energy also being slightly reduced, the rate and economy of gains are decreased.

The substitution of one part of linseed meal for one part of maize in a ration of clover hay one part and ground maize five parts, materially increases the rate of gains and the economy of gains. Steers which have been kept on a low plane of nutrition (maintenance) for a considerable time make more economical gains when put upon a full-feed ration than steers which have been upon full feed for some time. However, steers receiving more than a maintenance but less than a full-feed ration make no more economical gains when put upon full feed than steers which have already been on full feed.

From the results obtained in this investigation it seems safe to conclude that steers may be maintained or fattened with the ordinary rations of the corn belt on less digestible dry matter, on less digestible protein and on less net energy than the amounts prescribed by the generally accepted feeding standards.

**788 - Influence of the Age of the Cow on the Composition and Properties of Milk and Milk Fat.** -- ECKLES, C. H., and PALMER, L. S. (Missouri Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 12, pp. 643-655. Washington, D. C., December 17, 1917.

The question of the changes in the composition of milk with successive lactation periods and particularly the question relative to the percentage of fat in the milk of the heifer has been of great practical importance to the dairyman, as a possible index of what may be expected from the mature animals. The conclusions so far reached from data compiled by several investigators have not been entirely uniform. This paper offers new data on the question, taken from the records of the University of Missouri dairy herd, composed of pure-bred animals of the Jersey, Holstein, Ayrshire and Short-horn breeds.

The data showing the average percentages of fat for the successive lactation periods of all animals of each breed and similar data for the entire herd are given in Table I. An examination of the record of the individual animals of each breed, showed rather striking differences among the breeds with respect to the frequency with which the individuals of each breed showed the highest fat test in each lactation period. This frequency calculated as the percentage of cows of each group showing the highest test for each period is presented for each breed in Table II which may be referred to as a frequency table.

These data show that the percentage of fat in the milk of Jersey cows attains its maximum with respect to the average for the entire lactation period during any one of the first three periods, but the chances appear to be greater that this will be attained in the second or third period rather than the first.

TABLE I. — *Percentage of fat in milk in successive lactation periods.*

Number of cows	Period											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Jersey</i>												
74	4.99	5.04	—	—	—	—	—	—	—	—	—	—
59	4.96	5.04	5.01	—	—	—	—	—	—	—	—	—
45	4.95	5.04	5.03	4.84	—	—	—	—	—	—	—	—
30	5.09	5.17	5.20	4.97	5.00	—	—	—	—	—	—	—
20	5.09	5.20	5.22	4.92	4.92	4.76	—	—	—	—	—	—
11	4.93	5.00	5.09	4.80	4.76	4.68	4.63	—	—	—	—	—
4	4.89	4.90	5.05	4.68	4.54	4.68	4.61	4.58	—	—	—	—
4	4.86	4.83	4.83	4.47	4.56	4.64	4.62	4.58	4.47	—	—	—
3	4.86	4.83	4.83	4.47	4.50	4.64	4.62	4.48	4.47	4.22	—	—
2	4.99	4.90	4.75	4.50	4.44	4.76	4.70	4.48	4.49	4.33	4.22	—
2	4.99	4.90	4.75	4.50	4.44	4.76	4.70	4.48	4.49	4.33	4.22	4.01
<i>Holstein</i>												
26	3.22	3.10	—	—	—	—	—	—	—	—	—	—
20	3.23	3.06	3.09	—	—	—	—	—	—	—	—	—
11	3.26	3.05	3.12	3.10	—	—	—	—	—	—	—	—
8	3.27	3.01	3.06	3.12	3.03	—	—	—	—	—	—	—
6	3.36	3.07	3.15	3.16	3.10	3.41	—	—	—	—	—	—
5	3.33	3.06	3.11	3.11	3.06	3.18	3.11	—	—	—	—	—
1	3.29	2.99	3.03	3.08	3.09	3.05	3.00	2.88	—	—	—	—
<i>Ayrshire</i>												
9	3.90	3.88	—	—	—	—	—	—	—	—	—	—
9	3.90	3.88	3.79	—	—	—	—	—	—	—	—	—
6	4.04	3.92	3.81	3.64	—	—	—	—	—	—	—	—
4	4.01	3.97	3.78	3.68	3.82	—	—	—	—	—	—	—
2	4.06	4.08	3.79	3.83	3.84	3.79	—	—	—	—	—	—
1	4.10	3.90	3.87	3.99	3.87	3.76	3.65	—	—	—	—	—
1	4.10	3.90	3.87	3.99	3.87	3.76	3.65	3.38	—	—	—	—
1	4.10	3.90	3.87	3.99	3.87	3.76	3.65	3.38	3.58	—	—	—
<i>All cows</i>												
109	4.18	4.48	—	—	—	—	—	—	—	—	—	—
88	4.45	4.47	4.45	—	—	—	—	—	—	—	—	—
62	4.56	4.58	4.58	4.41	—	—	—	—	—	—	—	—
42	4.64	4.65	4.66	4.49	4.51	—	—	—	—	—	—	—
28	4.65	4.66	4.67	4.47	4.45	4.36	—	—	—	—	—	—
17	4.42	4.36	4.14	4.25	4.21	4.18	4.13	—	—	—	—	—
6	4.46	4.42	4.52	4.30	4.19	4.26	4.11	4.10	—	—	—	—
4	4.67	4.60	4.59	4.35	4.44	4.42	4.38	4.21	4.25	—	—	—
3	4.86	4.83	4.83	4.47	4.56	4.64	4.62	4.48	4.47	4.22	—	—
2	4.99	4.90	4.75	4.50	4.14	4.76	4.70	4.48	4.49	4.33	4.22	—
2	4.99	4.90	4.75	4.50	4.44	4.76	4.70	4.48	4.49	4.33	4.22	4.01

TABLE II. — *Relative distribution of highest average test for the lactation period.*

Number of cows	Lactation periods	Proportion of cows showing highest test in period:						
		1	2	3	4	5	6	7
<i>Jersay</i>								
74	2	48.7	51.3	—	—	—	—	—
59	2	47.5	52.5	—	—	—	—	—
59	3	39.0	32.2	28.2	—	—	—	—
45	2	44.5	55.5	—	—	—	—	—
45	3	33.3	33.3	33.3	—	—	—	—
45	4	26.7	31.3	28.9	11.1	—	—	—
30	2	40.0	60.0	—	—	—	—	—
30	3	30.0	36.7	33.3	—	—	—	—
30	4	23.3	36.7	30.0	10.0	—	—	—
30	5	16.7	30.0	37.0	10.0	13.3	—	—
20	2	30.0	7.0	—	—	—	—	—
20	3	20.0	40.0	40.0	—	—	—	—
20	4	15.0	40.0	40.0	5.0	—	—	—
20	5	15.0	35.0	40.0	5.0	5.0	—	—
20	6	15.0	35.0	40.0	5.0	5.0	0.0	—
11	2	27.3	72.7	—	—	—	—	—
11	3	18.2	36.4	45.5	—	—	—	—
11	4	18.2	36.4	45.5	0.0	—	—	—
11	5	18.2	36.4	45.5	0.0	0.0	—	—
11	6	18.2	36.4	45.5	0.0	0.0	—	—
11	7	18.2	36.4	45.5	0.0	0.0	—	—
<i>Holstein</i>								
29	2	88.5	11.5	—	—	—	—	—
29	2	90.0	10.0	—	—	—	—	—
29	3	70.0	10.0	20.0	—	—	—	—
11	2	100.0	0.0	—	—	—	—	—
11	3	81.5	0.0	18.2	—	—	—	—
11	4	63.7	0.0	18.2	18.2	—	—	—
8	2	100.0	0.0	—	—	—	—	—
8	3	100.0	0.0	0.0	—	—	—	—
8	4	87.5	0.0	0.0	12.5	—	—	—
8	5	87.5	0.0	0.0	12.5	0.0	—	—
6	2	100.0	0.0	—	—	—	—	—
6	3	100.0	0.0	0.0	—	—	—	—
6	4	100.0	0.0	0.0	0.0	—	—	—
6	5	100.0	0.0	0.0	0.0	0.0	—	—
6	6	83.3	0.0	0.0	0.0	0.0	16.7	—
5	2	100.0	0.0	—	—	—	—	—
5	3	100.0	0.0	0.0	—	—	—	—
5	4	100.0	0.0	0.0	0.0	—	—	—
5	5	100.0	0.0	0.0	0.0	0.0	—	—
5	6	83.3	0.0	0.0	0.0	0.0	16.7	—
5	7	83.3	0.0	0.0	0.0	0.0	16.7	0.0

TABLE II (*Continued*)

Number of cows	Lactation periods	Proportion of cows showing highest test in period						
		1	2	3	4	5	6	7
<i>Ayrshire</i>								
9	2	55.5	41.5	—	—	—	—	—
9	2	66.7	33.3	—	—	—	—	—
9	3	55.5	22.2	22.2	—	—	—	—
9	2	83.3	16.7	—	—	—	—	—
6	3	83.3	16.7	0.0	—	—	—	—
6	4	83.3	16.7	0.0	0.0	—	—	—
4	2	75.0	25.0	—	—	—	—	—
4	3	75.0	25.0	0.0	—	—	—	—
4	4	75.0	25.0	0.0	0.0	—	—	—
4	5	50.0	25.0	0.0	25.0	—	—	—

Holstein cows on the contrary almost invariably show the highest average percentage of fat for the lactation period during the first period and the conclusion seems justified that this is a breed characteristic.

Ayrshire cows more frequently show a higher average lactation test during the first than during subsequent periods, but less frequently than in the case of Holstein cows.

The variations in the average percentage of fat among the first few lactation periods are not sufficiently great to be of much practical importance but the gradual decline in average test accumulates to a figure of considerable importance as the number of lactation periods becomes greater.

The fact that certain of the animals of the Jersey and Holstein breeds whose records are included in the data, comprised an experiment to determine the influences of the plane of nutrition during growth and age of first calving upon the dairy qualities of cows, suggested that the two factors may have contributed to the difference in the character of the data from the two breeds.

The data concerning the influence of the plane of nutrition during growth, indicate that this factor may be of importance in connection with the average fat test for the first lactation period. The light-fed Jerseys showed both a lower average test in the first lactation period and also a less frequent tendency for this period to show the highest test, while the heavy fed Jerseys showed exactly opposite results. The strong breed tendency for the Holsteins to show a higher average test in the first lactation period than in any subsequent period was also materially diminished by light feeding during the growth of the animals.

It must also be considered that the light feeding of the animals for both breeds was by no means extreme, although it was widely different from the heavy feeding carried out with the other animals in the experiment.

The data bearing on the age of first parturition indicate that a difference of 16 months between the first parturition of the Jerseys had little influence upon the breed tendency already noted for the higher test to accompany the second lactation period. In the case of the Holsteins, however, calving at a more advanced age seemed to decrease the breed tendency for the first lactation period to show the higher average test. As far as the composition and properties of milk of aged cows is concerned neither the percentage composition of the milk nor the physical and chemical constants of the milk fat of aged cows show any abnormalities attributable to old age.

Butter made from the milk of a cow 19 years old and in her thirteenth lactation period was pronounced to be of excellent quality and kept for a period of three months at a temperature of 8° to 10° C, without showing any marked deterioration.

789 - **Researches on a New Galactogogue, in Italy.** — BRENTANA, D., in the *Rivista di Agricoltura*, Year XXIV, No. 18, pp. 141-142. Parma, May 3, 1918.

The author has studied the effect of injecting the animal with its own milk on the milk produced. The experiments were carried out on various cows and are still in progress. The results so far obtained appear to show that the injections really have an effect on the increase in milk yield of cows. The author, who will shortly deal with the matter more fully, presents the following note.

The best practical application of the method is to give a subcutaneous injection of 10 or 20 cc. of the cow's own milk every 10 or 20 days, commencing the tenth day after calving. The increase in milk production will be about 2 litres a day, and the composition of the milk will hardly vary. The technique of the method is very simple:—

1) Collecting 20-30 cc. of milk in a sterile recipient, after thoroughly cleansing the udder and the milker's hands.

2) Subcutaneous injection, under perfectly aseptic conditions, of 10-20 cc. in the cow from which the milk has been taken.

The author never had any trouble whatever with the injections that he made.

The treatment should be accompanied by adequate feeding for, if the udder can be stimulated, it is still necessary to provide the substances required for milk-formation.

790 - **Breeds of Dairy Cattle in the United States.** — DAVIS, H. P., in the *United States Department of Agriculture, Farmers' Bulletin 893*, pp. 1-36, Washington D. C., November, 1917.

In the United States five breeds of dairy cattle have attained considerable prominence, namely, the Ayrshire, Brown Swiss, Guernsey, Holstein-Friesian and Jersey. These breeds have been developed carefully for a considerable time for the purpose of dairy production and in consequence each transmits its characteristics with regularity to its offspring. Certain distinct features distinguish each breed from the others but all possess ability as milk producers.

**THE AYRSHIRE BREED.** — The first importation of Ayrshires in the

United States was made in 1822, since which time there have been frequent importations into both the United States and Canada. New England, New York and Pennsylvania probably contain the largest number of representatives of the breed. There is small distribution in the middle Atlantic States and the Pacific Northwest. In Canada Ayrshires have had great popularity and the breed seems able to withstand the rigour of the Canadian climate. In weight the cows vary from 900 to 1300 pounds with an average for the United States of about 1000 pounds; bulls weigh between 1400 and 2000 pounds averaging about 1600 pounds.

Probably none of the other dairy breeds can compare with the Ayrshires in ability to obtain a livelihood on scanty pastures and this ability has made them very useful in sections where there is much rough land in pasture.

Ayrshire milk is only slightly coloured, and the fat is divided in uniformly small globules which on the average are smaller in size than those of any other breed.

The average of the 2598 cows that have completed yearly records for advanced registry to July 1, 1917, is 9555 lb. of milk testing 3.95 % butterfat; amounting to 377.51 lb. of fat.

The 10 highest producers of the breed for butterfat to July 1917 (the milk yields given first being for comparison only) were:— 1) Lily of Willowmoor (22269): 22 596 and 955.56 lb.; 2) Auchenbrain Brown Kate 4th (27943): 23 022 and 977.60 lb.; 3) Imp. Garclaugh May Mischief (27944): 25 329 and 894.91 lb.; 4) Auchenbrain Yellow Kate 3d (36910): 21 123 and 888.33 lb.; 5) Jean Armour 3d (32219): 21 938 and 859.65 lb.; 6) Agnes Wallace of Maple Grove (25171): 17 657 and 821.45 lb.; 7) Netherhall Brownie 9th (23085): 18 100 and 820.91 lb.; 8) Garclaugh Spottie (27 950): 22580 and 816.25 lb.; 9) Gerranton Dora 2d (23853): 21023 and 804.79 lb.; 10) Jean Armour (25487): 20 174 and 774.73 lb.; the *average* being 21356.1 lb. of milk and 855.4 lb. of butterfat.

*Families.* On account of the comparatively recent origin of the breed few families have been developed. The more prominent in the United States are the Brownie, Auchenbrain, Finlayston, White Cloud, Jean Armour and Garclaugh May Mischief.

*Bulls.* The 10 Ayrshire bulls having the largest number of daughters with advanced-registry records to July 1917, are listed below, in Table I, together with the average production of their daughters.

The official organization of the Ayrshire breed in the United States is the Ayrshire Breeders' Association, with headquarters at Brandon, Vt. The secretary resides there and has charge of both registration and advanced registry work.

**THE BROWN SWISS BREED.** — The first importation of this breed into the United States was made in 1869 and comparatively few animals have since been brought into the country. The breed is not widely distributed in the United States being found principally in the States of New York and Wisconsin. The cows when mature weigh from 1100 to 1600 lb., with an average for the United States of about 1250 lb.; bulls range from 1500 to 2500 lb.

TABLE I. — *Ten Ayrshire bulls with largest number of advanced-registry daughters.*

Names	Number of daughters	Average pounds of milk	Average pounds of butterfat
g. Imp. Finlayston 882 . . . . .	78	10 513	431
2. Nox' emall 7312 . . . . .	79	9 646	367
7. Earl's Choice of Spring Hill 8 289 . . . . .	58	8 918	375
4. Imp. Morton Mains' Queechy 11 537 . . . . .	40	9 244	374
5. White Cloud of Hickory Island 10 377 . . . . .	36	11 133	435
6. Imp. Moustone of Drumsne 8 228 . . . . .	30	8 797	358
7. Imp. Holehouse White King 10 348 . . . . .	35	10 125	397
8. Imp. Howie's Dairy King 9 855 . . . . .	28	11 668	457
9. Benchan Peter Pan 12 971 . . . . .	27	11 414	438
10. Willowmoor Robin Hood 11 900 . . . . .	26	9 621	419

In disposition the cattle are mild and docile and for their size are very active; they are excellent grazers, especially on rough land.

In milk production this breed ranks well in the United States, with a moderate percentage of fat. The average of the 199 cows that have completed yearly records of production to June, 1917, is 10 868.7 lb. of milk testing 3.995 %, amounting to 433.45 lb. of butterfat.

The 10 highest butterfat producers of the breed (the milk yield given first being for comparison only) were: 1) College Bravura 2d (2577): 19 460.6 and 798.16 lb.; 2) Ethel B. (3842): 18 816.2 and 779.97 lb.; 3) Rosalind B. (3905): 16 804.4 and 727.64 lb.; 4) Iola (3923): 16 844.6 and 685.47 lb.; 5) Edna C. 3d (5092): 16 496.7 and 669.35 lb.; 6) Lottie G. D. (3530): 17 595.3 and 664.25 lb.; 7) Brownie F.: 17 420.8 and 662.25 lb.; 8) Kalliste W. (2905): 16 609.2 and 650.32 lb.; 9) Flora Duwire (4105): 16538.1 and 649.42 lb.; 10) Nau of Lake View (4061): 17 136.4 and 647.30 lb.; the average yield being 170 65.6 and 683.72 lb. respectively.

*Families.* Families of Brown Swiss have not been developed to any great extent in the United States.

*Bulls.* Only few bulls have more than one daughter in the Register of Production; the 11 with the largest number of daughters to June, 1917, are: Mc Avoy, 2068; Zell, 2512; Reuben, 2927; Casper C., 1999; Ben Hanson, 2373; Collier, 2075; Junker, 2365; Mack IV., 2901; Meeta's Son, 1747; Richard Esmond, 1342; Speedwell, 2582. The official organization of the Brown Swiss breed in the United States is the Brown Swiss Cattle Breeders' Association and the secretary for both registration and Register of Production resides at Beloit, Wisc.

**THE GUERNSEY BREED.** — The first representatives of this breed were imported into the United States in the early part of the nineteenth century, but not until the last quarter of that period were efforts made to keep the breeding pure by the establishment of a herd register. Since that time there have been importations almost every year and the breed has grown

steadily in numbers and popularity. At present the largest numbers are found in the Eastern States, the Middle Western States coming next.

Guernseys are medium in size, varying in weight from 900 to 1,400 lb., with an average for the United States of 1,050 lb.; the bulls range from 1,400 to 2,200 lb., averaging about 1,600 lb.

Guernseys possess a nervous disposition but are very quiet if properly handled.

Milk from Guernsey cows is noted for its extremely yellow colour and high percentage of butterfat. The fat globules are larger than those in milk from either Holstein or Ayrshire cows and consequently the cream rises more rapidly upon setting. The average of 6200 cows that have completed a year's record for the advanced Registry to August 15, 1917, is 8934.44 lb. of milk testing 4.99 %, amounting to 446.01 lb. of butterfat. The 10 highest butter-fat producers of the breed to August 1, 1917 (the milk yield given first being for comparison only), were:—1) Murne Cowan (19597): 24,008 and 1098.18 lb.; 2) May Rilma (22761): 19,673.0 and 1073.41 lb.; 3) Laughwater Hope (27946): 19,882.0 and 1003.17 lb.; 4) Yeksa's Tops of Gold's Fannie (22362): 19,794.9 and 981.53 lb.; 5) Spotswood Daisy Pearl (17696): 18,602.8 and 957.38 lb.; 6) Julie at the Chêne (30460): 17,661.0 and 953.53 lb.; 7) Belladgia (31909): 19,631.9 and 934.05 lb.; 8) Imp. Dairy Moon III (28471): 18,019.4 and 928.39 lb.; 9) Miranda of Mapleton (19606): 16,630.7 and 927.16 lb.; 10) Dairymaid of Pinchurst (24,636): 17,285.3 and 910.67 lb.; the average yields being 19,118.9 and 976.75 lb. respectively.

*Families.* There are a number of well-developed families of Guernseys, of which the following are among the more widely known:—May Rose, Glenwood, Masher's Sequel, Governor of the Chêne, Yeksa, Tricksey, and Sheet Anchor.

*Bulls.* Some of the leading sires, with their advanced-registry progeny are given below in Table II. They are arranged according to the number of their advanced-registry daughters to May, 1916.

The official organization of the Guernsey breed in the United States is the American Guernsey Cattle Club, and the secretary for both registration and Advanced Registry resides at Peterboro, N. H.

**THE HOLSTEIN-FRIESIAN BREED.**—The Dutch settlers in the State of New York were probably the first to import individuals of the Holstein-Friesian breed, but the first importations of which records exist were made between 1857 and 1862 and many of the present day animals are descended from these importations.

Holsteins have grown greatly in numbers and popularity in recent years, owing in a great degree to the increased demands in large cities for market milk. Cattle of the breed are most numerous in the Eastern and Middle Atlantic States, with the Middle Western and Pacific sections next in order. With the exception of the Jersey, there are more Holstein cattle in the United States than of any other dairy breed. The Holstein is the largest of the dairy breeds of the United States. Cows at maturity vary in weight from 1,100 to 1,800 lb., with an average for the United States of about 1,250 lb.; bulls range from 1,500 to 2,600 lb. averaging 1,800 lb.

TABLE II — *Sixteen Guernsey bulls, with largest number of advanced-registry daughters.*

Names	Advanced registry daughters	Sons with one or more daughters in advanced registry
1. Masher's Sequel 11 462	63	20
2. Governor of the Chêne R. G. A. S. 1 217 P. S.	52	20
3. Galaxy's Sequel 16 904	37	16
4. Masher, R. A. A. S. 63 F. S.	28	8
5. Cora's Governor, of the Chilmark 8 971	25	3
6. Glenwood Boy of Haddon 4 605	26	22
7. Glenwood's Main Stay 6 067	25	18
8. Lord May 14 357	25	3
9. Golden Noble 2d, R. G. A. S. 1 836 P. S.	24	4
10. Starlight's Excelsior 7 992	23	3
11. Princess's Jewel 24 577	23	1
12. King Coral 5 238	22	1
13. Governor 1st of the Chêne 105 63	22	0
14. Glenwood's Champion 15 639	20	0
15. Justinée's Sequel of the Prêle R. G. A. S. 2 119 P. S.	21	1
16. King of the May 9 001	17	9

In disposition Holsteins are docile and rather lazy in general habits as shown in their poor "rustling" ability in grazing scanty pastures. They are large consumers of feed, especially roughage, and do best when plenty is readily available. From the point of view of milk production Holsteins average higher than any other breed. The percentage of butterfat, however, which averages lower than that of any other dairy breed, tends to counterbalance the advantage of a greater production. The 3220 cows that have completed a yearly record for the Advanced Registry to February 19, 1917, averaged 14,622.7 lb. of milk testing 3.424% butterfat amounting to 500.7 lb. of fat.

The ten highest butterfat producers among Holsteins (the milk yield given first being for comparison only), were: — 1) Duchess Skylark Ormsby (124514): 27,761.7 and 1205.09 lb.; 2) Finderne Pride Johanna Rue (121083): 28,403.7 and 1176.47 lb.; 3) Finderne Holingen Payne (114551): 24,612.8 and 1116.05 lb.; 4) Queen Piebe Mercedes (154610): 30,230.2 and 1111.56 lb.; 5) Oma Button De Kol (115939): 26,761.2 and 1076.44 lb.; 6) Maple Crest Pontiac Application (141158): 23,421.2 and 1075.44 lb.; 7) Banostine Piebe De Kol (90441): 27,404.4 and 1058.34 lb.; 8) Royalton De Kol Violet (86460): 29,949.6 and 1036.45 lb.; 9) Keystone Beauty Plum Johanna (161616): 25,787.5 and 1035.77 lb.; 10) Pontiac Clothilde De Kol 2d (69091): 25,318.0 and 1017.28 lb.; the averages being 26,965.03 and 1090.98 lb. respectively.

*Families.* The families of the Holsteins are very numerous and it is difficult to determine which are the more important. Probably the following are among the more widely known: — Aaggie, Abbekerke, Artis, Beets,

Burke, Butter Boy, Carlotta, Clothilde Colantha, De Kol, Fayne, Gerben, Hartog, Hengerveld, Johanna, Korndyke, Mechthilde, Mercedes, Mutual, Netherland, Ormsby, Pieterje, Pietje, Pontiac, Sarcastic, Segis, Spofford, Vale, and Veeman.

*Bulls.* The bulls having the largest number of progeny with records, according to volume 27 of the Holstein-Friesian Blue Book, are listed below. (The records are for seven days).

TABLE III

		Number of tested daughters	Number of proved sons	Number of proved daughters
1.	King of the Pontiacs 39 037 . . . . .	186	99	46
2.	Pontiac Korndyke 25 982 . . . . .	135	69	66
3.	Lord Netherland De Kol 22 187 . . . . .	125	37	140
4.	De Kol 21's Butter Boy 3d, 23 260 . . . . .	118	94	80
5.	Hengerveld De Kol 23 102 . . . . .	116	65	84
6.	Poul Beets De Kol 22 235 . . . . .	105	49	92
7.	Homestead Girl De Kol Sarcastic Lad 32 558 . . .	105	38	56
8.	Aggie Corneopia Johanna Lad 32 551 . . . . .	102	68	68
9.	Colantha Johanna Lad 32 481 . . . . .	100	70	35
10.	Pieterje Hengerveld's Count De Kol 23 224 . . .	99	56	65
11.	Lilith Pauline De Kol's Count 28 430 . . . . .	93	55	67
12.	Korndyke Queen De Kol's Count 23 43 . . . . .	88	17	47
13.	King Segis 36 168 . . . . .	87	80	55
14.	Mercedes Juli's Pieterje's Paul 29 830 . . . . .	84	35	49
15.	Tity Abbekerk Prince 37 701 . . . . .	80	8	29

The Holstein-Friesian Association of America is the official organization of the breed in the United States with headquarters at Brattleboro, Vt. where the secretary resides. The headquarters of the Advanced-Registry work of the association is at Delavan, Wis.

**THE JERSEY BREED.** — Jerseys were first imported into the United States about the middle of the last century, and since that time importations have been made practically every year. The breed probably has the largest numbers and widest distribution of all the dairy breeds of the United States. Large numbers of Jerseys may be found throughout New England, the Middle West, the South and the Southwest. Jerseys are the smallest of the dairy breeds. Mature cows range from 700 to 1 300 lb., with an average for the United States of about 900 lb.; bulls vary from 1 400 to 2 000 lb., averaging 1500 lb.

Jerseys have a distinctly nervous disposition and are usually somewhat excitable. Their highly organized nervous system causes them to respond quickly to good treatment and abundant feed.

In natural yellow colour the milk of Jersey cows ranks next to that of Guernsey cows and is usually slightly richer in butterfat. The large fat globules cause the cream to rise readily upon standing. The average of

the 5,244 cows that have completed yearly records for the Register of Merit is 7,792 lb. of milk testing 5.35 %, making 417 lb. of butterfat.

The ten highest butterfat producers among Jerseys (the milk yields being given first for comparison only) were:—

1) Sophie 19th of Hood Farm (189748): 17 557.7 and 999.1 lb.; 2) Spermfield Owl's Eva (193934): 16 457.4 and 993.3 lb.; 3) Eminent's Bess (209719): 18 782.9 and 962.8 lb.; 4) Dosoris Park Lily (233783): 16 728.1 and 957.4 lb.; 5) Jacoba Irene (140443): 17 253.2 and 952.9 lb.; 6) St. Mawes Poppy (219992): 15 782.4 and 952.3 lb.; 7) Olympia's Fern (252060): 16 147.8 and 937.8 lb.; 8) Lass 66th of Hood Farm (271890): 17 793 and 910.6 lb.; 9) Lass 38th of Hood Farm (223628): 15 284 and 890.4 lb.; 10) Spermfield Owl's Temisia (215982): 15 147.1 and 875.2 lb., the averages being respectively 16693 and 943.1 lb.

*Families.* A considerable number of families have been developed and it is difficult to determine which are the most prominent, but probably the following are among the best known:— St. Lambert, Rioter, Tormentor, Golden Lad, Flying Fox, St. Helier, Combination, Oxford, Financial King, Owl, Jacoba, St. Mawes, Eminent, Diploma and Torono.

*Bulls.* Some of the Jersey bulls having the largest number of Register of Merit daughters to July, 1916, were:—

1) Hood-Farm Pogis 9th 55552 with 78; 2) Hood Farm Torono 69326 with 71; 3) Spermfield Owl 57088 with 48; 4) Loretta's King 65050 with 39; 5) Interested Prince 58 224 with 39; 6) Raleigh's Fairy Boy 83767 with 39; 7) Hector Marigold 59121 with 33; 8) Gomboge's Knight 95 698 with 33; 9) Noble of Oaklands 95700 with 33; 10) Saydns's Heir 45360 with 33; 11) Royal Majesty 79313 with 32.

The American Jersey Cattle Club is the official organization, with headquarters at 324 West Twenty-third Street, New York, N. Y., which is the office of the secretary for both registration and Register of Merit.

91—**Establishment and Management of the Dairy Farm in India.**—KELKAR, RAO BHANUDUR G. K., in *Department of Agriculture, Bombay, Bulletin No. 86*, pp. 1-60. Poona, 1917.

Since 1908, when a bulletin on the establishment and management of dairy farms was first published by the Department of Agriculture of the Bombay Presidency, the dairy industry has developed considerably all over India, and the Military Department especially has taken up this work very seriously and has opened dairies and dairy farms all over India with up-to-date equipment and machinery. Even with regard to the civil population the question of supplying good milk to cities and towns has come into great prominence at present. This bulletin has been therefore prepared as a guide for people intending to enter this new industry.

**THE DAIRY HERD.**—The common dairy breeds in the Bombay Presidency are:—

*Cows:*—Aden, Sindhi or Karachi, Gir or Surti, Kankrej and Krishna Valley. The last two are also good work breeds.

*Buffaloes:*—Jafferabadi, Dehli, Surti or Nadiadi, Deccani, Varadi, and Nagpuri.

The following table will give an idea of the prices, live weight and average annual milk yields as compiled from the records of the Civil Dairy Kirkee.

TABLE I.

Name of Breed	Average price per head in Rs.	Average live weight in lb.	Average number of animals in the herd	Period under observation, years	Average annual yield per head in lb.
<i>Cows :</i>					
Aden . . . . .	75-100	500-600	5	12	1972
Sindhi . . . . .	125-150	650-750	26	12	2022
Gir . . . . .	75-100	700-800	9	10	1604
Kankrej . . . . .	75-100	700-850	—	—	—
Krishna Valley . . . . .	100-125	900-1000	—	—	—
<i>Buffaloes :</i>					
Jaffrabadi . . . . .	120-175	1100-1300	11	10	2476
Delhi . . . . .	150-200	1000-1200	11	10	1858
Surti or Nadiadi . . . . .	125-150	900-1000	37	12	2161
Deccani . . . . .	75-100	600-750	6	8	1275
Varadi . . . . .	100-125	800-1000	—	—	—
Nagpuri . . . . .	100-125	800-1000	—	—	—
<i>Bulls :</i>					
Aden . . . . .	100-150	700-850	—	—	—
Sindhi . . . . .	150-200	1000-1100	—	—	—
Gir . . . . .	100-125	1100-1250	—	—	—
Kankrej . . . . .	175-200	1000-1250	—	—	—
Surti . . . . .	100-125	1000-1150	—	—	—
Delhi . . . . .	150-200	1000-1250	—	—	—

POSSIBILITIES OF IMPROVEMENT. — Although the average yield of the Sindhi cows and of the Surti and Delhi buffaloes is 2022 lb. and 2161 lb. respectively still there are individuals which give much higher yields than the average as shown by the milk records of the Civil Dairy Kirkee which are given in Table II.

TABLE II.

Name of animal	Name of breed	Years under observation	Average annual milk yield, lb.	Average annual yield of the whole herd of the breed, lb.
<i>Cows :</i>				
Zankar . . . . .	Sindhi	13	3413	—
Chauguni . . . . .	"	5	3551	2022
Mohan . . . . .	"	9	2968	—
<i>Surti Buffaloes :</i>				
Kaveri . . . . .	Surti	13	3095	—
Sajani . . . . .	"	9	3526	2161
Lavangi . . . . .	"	7	3987	—

There is a further possibility of improvement by crossing the Sindhi cows with an Ayrshire bull. The results obtained at the Military Dairy Farms, Southern Circle, are encouraging as will be seen from the yields of cows noted in Table III which have completed one lactation period:—

TABLE III. *Military Dairy Farm Kirkee.*

No. of cow	Cross	Average milk yield of the cross per period	Average milk yield of dam	No. of cow	Cross	Average milk yield of the cross per period	Average milk yield of dam
		lb.	lb.			lb.	lb.
1	Ayrshire × Sindhi	4308	3329	9	Ayrshire × Sindhi	4934	2148
2	"	3450	3229	13	"	8506	2761
3	"	4593	2260	14	"	3517	1986
4	"	3364	2578	16	"	7500	3268
5	"	4367	1471	26	"	4375	2068
7	"	2170	1076	24	"	5200	1973
8	"	3311	1683	6	Ayrshire × Hansi	4798	2734
14	"	7310	2017	Average		4789.5	2358.1

Table IV shows the average analyses of average samples of milk from 9 Sindhi cows and 27 buffaloes milked at the Agricultural College Dairy, Kirkee, between 2 and 4 a.m. in the morning and 12 and 2 in the afternoon.

TABLE IV.

9 Sindhi cows		Buffaloes herd (27 head)	
		Morning milk	Evening milk
Constituents:			
Water	%	86.75	85.91
Fat		4.29	5.42
Casein		3.12	2.95
Milk sugar		5.28	5.40
Ash		0.70	0.69
		0.78	0.80

The relative proportion by weight of butter fat to milk in the average daily yield of Sindhi cows and of the whole buffalo herd is shown in Table V.

TABLE V.

Description of animal	Average quantity of milk per head in one day		Average quantity of butter fat per head in one day		Remarks
	lb.	oz.	lb.	oz.	
Cows (Sind)	13	14	—	0.87	1 lb. butter from 12 lb. milk
Buffaloes	9	2	—	14.37	1 lb. butter from 11 lb. milk

Approximately 1 lb. of cream is obtained from 6 to 8 lb. of buffalo's milk and from 10 to 12 lb. of cow's milk and 1 lb. of butter is obtained from 12 to 14 lb. of buffalo's milk and from 20 to 24 lb. of cow's milk. This standard is, however, found to vary month by month, as will be seen from the figures given in Table VI.

TABLE VI. — *Average number of pounds of buffalo's milk required to make a pound of butter during each month in the year.*

Month	Milk in lb.	Month	Milk in lb.	Month	Milk in lb.
April . . . . .	9.9	August . . . . .	12.1	December . . . . .	11.0
May . . . . .	9.9	September . . . . .	12.2	January . . . . .	11.1
June . . . . .	11.6	October . . . . .	12.1	February . . . . .	10.2
July . . . . .	11.8	November . . . . .	11.0	March . . . . .	10.9

According to Indian processes 15 to 18 lb. of buffalo milk are required to produce one pound of home-made buffalo butter, containing 17.45% moisture, 81.61% fat, 0.86% casein and 0.08% ash. This butter yields about 80% of "ghee", or clarified butter, obtained by evaporating the water by boiling it on a low fire for about 30 minutes; "Ghee" from fresh buffalo butter can be kept for about 2 to 3 months without any deterioration.

In outlying villages in India, where there is no demand for milk, or "ghee", desiccated milk called "Khawa" is prepared from whole milk from which cream is partially removed by setting it in shallow pans. The milk is boiled in large open vessels, until most of the water is driven off. When the mass is sufficiently thick, it is allowed to cool and is made into balls and sent out to "Halwais" (confectioners) who mix Khawa with fine sugar and turn it into "pedhas" and "burphis" which are the favourite sweetmeats of the Indians.

"Khawa" is also made from separated milk in North Guzerath. About 12 lb. of milk is required to produce one pound of "khawa", but when the whole milk is fresh and unadulterated it takes only 4 lb. to produce one pound of "Khawa".

The business aspect of the dairy industry is discussed by the writers in detail under the following headings: Equipment, machinery and other dead stock, management and labour, dairy buildings, scheme for continuous supply of green fodder, recurring annual expenses, recurring expenditure of feed and maintenance of live stock, and record sheets to be kept on a dairy farm of 200 head of cattle.

792 — *Testing of Purebred Dairy Cows in New Zealand.* — SINGLETON, W. M., in *The Journal of Agriculture*, Vol. XVI, No. 2, pp. 63-75. Wellington, February 20, 1918.

The support accorded by the breeders of purebred dairy cattle in New Zealand to the certificate-of-record testing system, during recent

years evidences an effort that will produce a marked influence on the economic position of the dairy industry in New Zealand.

The following table shows the number of certificates issued during each calendar year since the inception of the system.

Breed	1913		1914		1915		1916		1917	
	Ordinary	Repeat								
Jersey . . . . .	67	104	14	91	3	94	11	94	12	
Friesian . . . . .	48	67	11	62	9	44	5	62	14	
Ayrshire . . . . .	—	17	1	12	1	9	—	4	3	
Shorthorn . . . . .	—	—	—	2	—	7	—	21	—	
Totals . . . . .	115	188	26	167	13	154	16	181	30	

The number of breeders now testing cows shows an increase of 20 per cent over the number testing a year since, and with sufficient testing staff could have been increased to 25 per cent.

The work is destined to make rapid growth in New Zealand, with the coming of normal conditions.

Not a sufficient proportion of the breeders are yet possessed of a due appreciation of the work, and not a sufficient percentage of the dairy herds are yet headed by a purebred butter-fat-record dairy bull. The growth of dairy husbandry in New Zealand, however, suggests that for many years to come the scope for this work will be unlimited. During the year 1917 certificates have been issued for eight Friesian records of production exceeding 600 lb. of butter fat. Three of the class-averages show an increase over the preceding season. The complete figures for 1917 are as follows:

Class	No. of cows	Average yield for Season		
		Days in milk	..	
			lb.	lb.
Junior two year-old . . . . .	12	346	9 887.60	353.73
Senior two-year-old . . . . .	11	323	9 655.00	326.08
Junior three-year-old . . . . .	4	361	12 797.10	455.98
Senior three-year-old . . . . .	4	343	13 711.84	480.37
Junior four-year-old . . . . .	9	353	13 615.90	475.72
Senior four-year-old . . . . .	6	359	17 250.00	601.57
Mature . . . . .	30	333	14 123.04	495.08

The class production average for the Jersey breed in 1917 was as follows: —

Class	No. of cows	Average yield for Season		
		Days in milk	Milk	Fat
		lb.	lb.	lb.
Junior two-year-old . . . . .	39	345	6 429.10	360.62
Senior two-year-old . . . . .	9	323	5 912.40	318.82
All two year-old . . . . .	48	340	6 123.90	352.70
Three-year-old . . . . .	19	328	7 176.40	398.21
Four-year-old . . . . .	9	340	7 926.60	410.53
Mature class . . . . .	31	347	8 454.99	460.92

The Ayrshire class leaders for 1917 were as follows : —

Class	Age at testing	Fat required for certificate	Yield for Season		
			Days	Milk	Fat
Years	Days	lb.	lb.	lb.	lb.
Two-year-old . . . . .	2	348	275.3	365	12 583.00
Three-year-old . . . . .	3	321	309.1	365	11 604.20
Four-year-old . . . . .	4	318	348.3	365	14 348.60
Mature . . . . .	6	354	350.0	365	14 636.00

The work connected with the C. O. R. testing has been much decreased by the cooperation of the secretaries of the several breeders' associations.

**793 - Development of Cow-Testing Associations in the United-States.** — *The United States Department of Agriculture Weekly News Letter*, Vol. V, No. 21, p. 5. Washington, D. C., January 16, 1918.

Cow-testing associations, as a result of work by the Bureau of Animal Industry of the U. S. Department of Agriculture, have continued to increase until there are now 472 active associations composed of 12 088 dairymen, owning 216 831 cows. The past year showed a gain of 37 per cent in number of associations. The cows tested constitute almost 1 per cent. of all the dairy cows in the United States, the total number of milk cows on January 1, 1918, being in round figures 23 284 000. The most noticeable development of cow-testing associations has been in the Western States.

**794 - Goat Milk Records of the New York Agricultural Experiment Station.** — JORDAN, W. H. and SMITH, G. A., in *New York Agricultural Experiment Station Bulletin* No. 429, pp. 1-20. New York, 1917.

For three years an accurate record was kept, at the New York Agricultural Experiment Station, of the individual milk production of the animals included in the herd of milk goats: the cost of maintenance was determined, as well as the cost of milk and the composition of the milk.

The quantity of food consumed by 31 adult and 9 partially grown ani-

[793-794]

imals during the third year was as follows: Dry coarse food 37,740 lb; Beets, 1,550 lb.; Cut grass, 24,000 lb.; Pasture, 132 days; Grain, 14,688 lb.

The total cost of this food at the prices then ruling was \$441.95. The average cost per month per goat varied from \$0.481 to \$0.992. The average cost of food per goat per year was \$11.05 making the daily cost \$0.03.

The average yearly yield for 10 animals during 3 years, including lactation periods was 800.4 pounds.

The food cost of the milk per goat for all the goats during the third year was 4 cents per quart, and, for the three years during which the record was kept, 3.4 cents. The lowest cost was with the Saanen goat No. 11, for the second year, which was estimated to be 1.27 cents per quart. The other items of cost, such as care and overhead charges, it is not possible to give with any accuracy. The average food cost for a quart of milk from the Station herd of 25 Jerseys during the three years has been found to be 0.92 cents per quart.

The range of composition of the mixed milk of the whole flock as determined during the third summer was as follows: solids, 11.4 % to 11.9 %; solids not fat, 7.72 % to 8.61 %; fat 3.5 % to 3.8 %.

The composition of milk from individual goats was found to vary in total solids from 9.22 % to 18.55 %; in protein from 2.24 % to 4.96 %; in casein from 1.56 % to 4.6 %; in fat from 1.08 % to 8.4 %; and in ash from 0.43 % to 0.8 %.

A chemical study of goat's milk indicated no essential difference between the constitution of its casein and that of cow's milk. Marked and probably important differences were observed in the salts of the ash as compared with the ash of both cow's milk and human milk.

195 - **Breeds of Pigs in Brazil.** - HUNNICKET, B. H., in *Chacaras & Quantas*, Vol. XVII, No. 3, pp. 183-184, 1 Fig. São Paulo, March, 1917.

The native pigs of Brazil are, generally speaking, very good animals. They form more or less fixed types, usually considered as breeds, although they lack certain qualities necessary for this. The chief are: - "Canastão"; "Canasta"; "Canastrinho" or "Tatú"; "Crioulo". The first three types, which are large, medium and small respectively, are fine fat producers. As they are not pure breeds, they lack fixed characters, and in addition, have the defect of being slow to arrive at maturity.

Foreign breeds have been tried in Brazil; with the results given below.

*Yorkshire*: - very susceptible to skin diseases and suffers from the heat heat.

*Tamworth*: - being more suited for meat than lard production, which is the chief aim in Brazil, it cannot be bred on a large scale.

*Berkshire*: - seems suitable for Brazil, but has two serious disadvantages; it easily degenerates and the progeny of crosses with it lack stability.

*Poland China*: - fattens easily, docile temperament, gives good crosses which are not very prolific, lacks hardiness and easily degenerates.

*Large Black*: - suitable for small scale rearing, seems on the contrary to be little suited for large-scale rearing under Brazilian conditions.

*Mule foot ("Casco de burro")* :— the statement that it does not suffer from disease appears unjustified.

*Duroc-Jersey* :— large, giving much fat and good meat, very fertile, hardy, good for crossing with native animals, fairly early-maturing.

Systematic selection is indispensable for the creation of a fixed national breed ; but the breeder has, in crossing with improved foreign pure breeds, a much surer and more rapid method for increasing and improving the production of butcher's animals.

**796 — A Study of the Effect of Cottonseed Meal versus Beef Scrap Upon the Egg Production, Fertility and Vitality of Poultry.** — AHRENS, B. A., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Stillwater, Bulletin No. 112*, pp. 20 + 21 Tables. Stillwater, January, 1917.

The object of these experiments was to determine the value of cottonseed meal as a feed for egg production when compared with beef scrap, and to determine also the effect of cottonseed meal in moderate as well as in excessive quantities upon the fertility and hatchability of eggs. The discussion of the data from these experiments is divided into two parts: Part I contains all data relating to the breeding; Part II contains data which show the value of the protein from the two sources as a factor in egg production. The conclusions arrived at are as follows :—

1) Cottonseed meal fed in combination with other feeds to form a proper nutritive ratio, or even when fed in excess, does not lower the fertility of domestic fowls, but in many cases the fertility was higher than when beef scrap or animal protein was used.

2) The percentage of fertile eggs hatched shows greatly in favour of cottonseed meal when compared with beef scrap if fed in a properly balanced ration, but when fed in excess gives rather poor hatching results.

3) The percentage of all eggs hatched also shows in favour of cottonseed meal compared with beef scrap when fed in a properly balanced ration, but when fed in excess the results are very poor.

4. As a feed for production of eggs only, and not considering effect on hatchability, beef scrap is superior to cottonseed meal, and more than makes up for its greater cost by apparently causing greater production.

5). The mortality of chicks was a great deal higher in pens fed cottonseed meal, both the normal and excessive ration.

**797 — Capons and Castration.** — SLOCUM, R. B., in *U. S. Dept. of Agriculture, Farmer's Bulletin 840*, pp. 15, 10 Fig., Revised Edition. Washington, December, 1917.

A bulletin for the use of poultry-farmers.

Large breeds, such as the Plymouth Rocks, Light Brahmans, Cochins, Indian Games, Langshans, Wyandottes, Orpingtons, and various crosses of these make the best capons. Cockerels should be castrated when they weigh from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  lb. or when from 2 to 4 months old. The capons should be sold when 10 months old.

**798 - The Second Rearing of Silkworms in Italy, during Summer and Autumn, 1917.**

— CASELLA, L. G., in *Informazioni Seriche*, Year V, No. 2, pp. 19-20. Rome, January 20, 1918.

The propaganda work for the second rearing of silkworms was helped in 1917 by the sale prices for the spring season, as well as by the quantity of unutilised mulberry leaves.

The amount of seed used for that rearing was certainly more than 15 000 ounces of 30 gm., since in Piedmont alone from 8 000 to 10 000 were hatched.

To ascertain the work done in each district by the competent institutions and the rearers, the Minister for Agriculture, who had distributed 1103 ounces of eggs hatching out of season and 403 ounces of eggs preserved by the embryostatic method, distributed a circular accompanied by a number of questions to be answered. The reports received by the Ministry of Agriculture, the most interesting of which were those of the "Associazione serica" of Piedmont, the "R. Scuola di setificio" of Como, the "Comitato per l'incremento della bacicoltura" of Milan, and of the "R. Osservatorio bacologico" of Cosenza, were examined to obtain the conclusions of greatest interest regarding the second rearing.

These reports show that with suitable climatic conditions and where the second rearings were suitably attended to, the rearings were quite advantageous. The cocoons were considered excellent, and were mostly sold at prices above 9 fr. the kg., even 15 fr. in Piedmont, and with a general average of 12.21 fr.

There were yields higher than 40 kg. per ounce, some even reaching 60 kg. On the other hand, under not very favourable conditions many rearings gave limited yields, some even proving failures.

The period indicated as being most suitable, begins at the end of August, and varies according to local conditions.

The studies and experiments on the most suitable varieties of eggs to use should be continued, and a more thorough preparation of the eggs should be encouraged by giving premiums to those who are successful. Intensive propaganda work should be carried out to spread good systems of rearing, and thus decrease the number of failures.

**799 - Sericulture in Cyprus. — *The Cyprus Agricultural Journal*, Vol. XIII, Part. 1, pp. 16-19. Nicosia, January, 1918.**

During 1916-1917, the sericultural stations of Nicosia, Paphos, Vialoussa, Lapithos, and Morphon were very active. In these stations the new Cypriot race produced by the cross Japanese X Bagdad was reared, in order to fix and improve it. The breed showed improvement when compared with that of the previous year. The following results were obtained at the Nicosia Station: — *length of cocoon*: minimum = 39 mm, maximum = 44 mm. ; *width of cocoon*: min. = 20 mm., max. = 22 mm. ; *weight* = 3.07 gm. One ounce of seed produced 39.6 kg of cocoons. To obtain 1 kg. of raw silk 10.02 kg. of cocoons are required.

800 — **The Problem of the Restocking of the Alpine Lakes.** — GALLI-VALERIO, B., in the *Bulletin Suisse de Pêche et Pisciculture*, Year XIX, No. 2, pp. 18-21, Neuchâtel, February, 1918.

The restocking of the alpine lakes with fish is of considerable economic importance, especially in Switzerland on account of their large number (615 in the canton of Grisons alone). All those that are sufficiently deep are suitable for stocking with trout, as the water does not freeze down to the bottom. Nearly all are of this type, since the thickness of the ice in the alpine lakes does not exceed 32 in. The altitude is of little importance, as lakes over 6500 ft. are well stocked with trout, but on the contrary, the food question is very important. The researches carried out by PERO (*Nuova Notarisia*, 1893, pp. 3 and 47; 1894, p. 135) in the Valteline showed that algae, crustacea, insects, molluscs, and often small fish such as the minnow (*Phoxinus laevis*), are abundant in the lakes of that region and provide the conditions required for feeding trout.

The pests affecting pisciculture in that region are chiefly the otter, a rare animal, the water-shrew (*Crocidura fodiens*), the water-rat (*Arvicola amphibius*), a fish, the bull-head (*Cottus gobius*), that lives in lakes even above 6500 feet, and which devours large quantities of trout-eggs. But according to the author's observations, the greatest enemies of restocking the alpine lakes are the trout themselves, when they have grown too big, for they eat the fry and small trout.

As regards the species to choose for restocking, the author rejects *Trutta lacustris*, because it has the disadvantage that one or two individuals grow more than the others and destroy all the rest. The author tried *T. fario* from the Adda and its tributaries in the Publino Valteline lake, at 6500 ft., but found it had the same disadvantage as the previous species.

For restocking alpine lakes, a breed of *T. fario* should be used that has been bred in those lakes for generations, and which almost constitutes a distinct breed, characterised as it is by an almost black body, with brilliant red dots, almost orange flesh, and which always remains small (7 to 8 in.) so that there is no risk of one or two developing greatly, followed by the destruction of all the others. As the salmon (*Salmo salvelinus*) also occurs in certain alpine lakes, especially in the Tyrol, the author stocked lake Venina, Valteline (6022 ft.), with it, and obtained excellent results. Up to the present the lakes of the Swiss alps have been chiefly stocked with *S. irideus*.

#### FARM ENGINEERING.

801 — **State Motoreculture in France and Italy.** — I. *Journal Officiel de la République Française*, Year XLIX, No. 312, pp. 9207-9214, 6 Tables. Paris, November 17, 1917. — II. *Le Génie Rural*, Year X, No. 78, pp. 10-12, 1 Table. Paris, 1917. — III. MAROZZI, ANTONIO, in *L'Industria*, Vol. XXXII, No. 2, pp. 37-39, 2 Figs. Milan, January 31, 1918.

I. — The French " *Journal officiel* " publishes the report on the Cultivation Department (" *Service de la mise en culture des terres* ") created by the law of January 2, 1917 and in virtue of the decree of April 7, 1917,

which defines the functions of the department, specially as regards carrying out and superintending cultivation work, the purchase and upkeep of teams of tractors.

TABLE I. — *Financial Statement of the Service (in francs).*

Team	Name and number of tractors	Staff and various	Fuel	Subsidy of the auto- mobile service <sup>(1)</sup>	Spare parts	No. of hectares worked	Cost price	General cost penses	Total price
3	10 Mogul 12-25 HP.	16 975.69	29 512.69	1 800	4 728.00	656	81	4	85
4	10 Emerson. . . . .	18 148.79	28 778.54	1 800	3 017.85	182	251	14	265
5	10 Case . . . . .	14 002.64	18 206.18	1 800	1 656.00	292	122	8	130
7	10 Mogul 16 HP. . . .	17 204.39	29 505.57	1 800	4 094.60	655	66	4	72
8	10 Emerson. . . . .	19 000.80	28 878.65	1 800	8 018.00	812	69	3	72
9	10 Mogul 8-16 HP. . . .	18 395.30	18 401.56	1 800	2 377.00	316	129	8	137
10	10 Mogul 8-16 HP. . . .	19 273.00	28 022.78	1 800	4 189.00	740	72	3	75
11	10 Emerson. . . . .	15 405.17	12 259.30	1 800	745.50	262	116	9	123
12	10 Emerson. . . . .	18 021.95	22 941.43	1 800	6 898.40	518	95	5	100
13	10 Emerson. . . . .	14 367.11	17 417.03	1 800	2 925.95	275	132	9	141
14	10 Emerson. . . . .	15 713.36	19 736.64	1 800	1 240.00	408	93	6	99
15	10 Emerson. . . . .	14 545.00	20 161.00	1 800	848.50	401	108	6	114
17	10 Emerson. . . . .	19 618.10	27 147.73	1 800	13 543.65	548	113	5	116
18	4 Mogul 8-16 HP. and 6 Emerson. . . . .	15 426.95	12 856.30	1 800	6 014.30	145	249	18	267
19	10 Emerson. . . . .	16 191.40	14 270.45	1 800	1 685.00	273	124	8	132
20	10 Emerson. . . . .	18 434.67	25 354.79	1 800	3 914.00	516	96	5	101
21	10 Emerson. . . . .	14 808.70	12 712.50	1 800	2 508.00	263	121	9	130
22	10 Case 12-25 HP. . . .	17 009.85	21 043.66	1 800	682.50	379	107	7	114
23	2 Fowler sets . . . . .	12 819.61	8 277.32	Depre- ciation of the material	—	473	69	5	74
					11 850				
25	10 Case 12-25 HP. . . .	21 848.13	47 509.89	1 800	2 881.00	1 198	61	2	63
26	10 Case 12-25 HP. . . .	16 324.60	38 406.35	1 800	723.50	642	89	4	93
27	10 Case 12-25 HP. . . .	17 082.65	30 029.97	1 800	1 791.00	988	51	3	54
28	10 Case 12-25 HP. . . .	16 542.15	33 767.87	1 800	818.00	1 091	75	4	79
29	10 Case 12-25 HP. . . .	14 071.50	35 797.57	1 800	1 994.00	538	99	4	103
30	10 Case 12-25 HP. . . .	17 591.28	42 348.76	1 800	1 003.00	1 121	55	2	57
31	10 Case 12-25 HP. . . .	16 070.50	39 355.23	1 800	1 148.00	855	65	3	71
32	10 Mogul 8-16 HP. . . .	14 499.21	17 095.77	1 800	1 682.00	565	62	4	66
33	10 Case 12-25 HP. . . .	18 897.28	42 350.04	1 800	1 574.00	1 136	50	2	58
35	10 Avery 8-16 HP. . . .	13 420.40	16 585.51	1 800	3 140.00	388	90	5	95
36	10 Avery 8-16 HP. . . .	11 303.50	13 042.17	1 500	1 990.00	182	153	10	163
37	3 Fowler sets . . . . .	21 516.04	15 67.82	Depre- ciation of the material	—	974	64	2	66
					22 000				
38	10 Rock Island 10-20	6 302.95	10 076.10	1 200	1 670.00	270	73	3	76
39	10 Titan 10-20 HP. . . .	4 560.30	9 005.30	600	1 780.00	180	93	3	90
40	10 Bull 20 HP. . . . .	6 006.27	9 965.57	600	1 315.00	236	75	3	78
42	3 Fowler sets . . . . .	4 670.20	3 524.00	6 825	—	273	55	3	58

(1) The Minister of Armament has allowed the Service a subsidy of 600 fr. per month per team for spare parts, repairs, etc.

The Department includes:— 1) a *Central Service* divided into several sections:— Secretary's office; Cultivation work; Material; Staff; Accountancy; Studies and Researches; Relations with private persons; 2) an *external Service*, which deals with the teams of 10 tractors supervised by a team-foreman who has under his orders an assistant-foreman, 2 mechanics, 2 smiths and a number of drivers. The technical section is responsible for the upkeep and repairs, as well as the provision of spare parts and tools for 372 tractors of 11 different types or makes, 393 ploughs of 9 different types or makes, 158 harvesters of 4 different types or makes, and 21 cultivators.

The report furnishes information as to spare parts, the service rendered by the central store, the supervision and repair of the tractors, motor lorries, travelling workshops, store cars, to the total number of 72.

After a detailed consideration of the organisation of the staff the report gives the results obtained during July, August, and September, 1917.

During these three months the teams have ploughed 47,577 acres, harvested 6,585 acres, scarified 1,703 acres, broken up 964 acres, and harrowed and rolled 3,188 acres. This work was carried out in 14,422 working days.

In Table I is given the financial statement of the department, whose general administrative expenses are divided among the teams of tractors. The cost per hectare for the different teams is given, the depreciation of the material, however, not being always included.

The report continues the description of the organisation of the Cultivation Department; it gives details as to insurance against accidents and fires; it gives full information as to the work and the section for fuels and lubricants, and concludes by showing the utility of the new Department which, according to the directors of the agricultural departments and the farmers themselves, has assured the re-awakening of agricultural life in the abandoned soils, thanks to the use of tractors. The report also indicates the results obtained by giving the farmers such information as to enable them to choose the tractors best suited to their needs.

TABLE II. — *Yields of the first 3 makes of tractor.*

Number of days July-August-September	Number of tractors	Area worked acres	Average yield per day for the whole of the machines acres	Yield per day and per machine. acres	Average cost per acre ploughed
1) EMERSON					
92	112	112.31	121.8	1.04	£ 2.5.10
2) CASE					
92	110	194.01	210.8	2.10	£ 1.6.5
3) MOGUL					
92	54	73.88	78.	1.48	£ 2.1.7

II.—The *Génie Rural* in commenting on the financial and technical results obtained by the Department, notes that they varied greatly, not only for the different types of tractors, but also for the various units made up of the same type.

Neglecting the FOWLER units, which proved to be the most economical as regards their yield per acre, it is found that the 32 other units included 116 EMERSON, 100 CASE, 54 MOGUL, 20 AVERY, 10 ROCK ISLAND, 10 TITAN and 10 BULL tractors.

In Table II (page 870) are compared the yields of the first 3 makes, bought in greater number and which have worked through a whole period, thus giving complete information. Table III gives the cost of spare parts.

TABLE III.—*Cost of spare parts.*

Number of tractors	Total cost	Cost per tractor	Cost per acre ploughed
116 Emerson	£ 194. 15. 5	£ 16. 15. 2	3s. 5.4d.
10 Case	574. 5. 0	5. 14. 7	7.1d.
54 Mogul	773. 4. 5	14. 6. 2	2s. 1.3d.

III.—The author describes the organisation of State Motoculture in Italy.

The "Ufficio Agrario Temporaneo" (temporary agricultural office), attached to the Ministry for Agriculture, makes out schemes for work in each zone of Italy, with the help of the directors of the Travelling Chairs of Agriculture and the regional delegates for increased food production.

At the request of this office, the "Ufficio Temporaneo degli approvvigionamenti" buys the machines, fuels and lubricators; it is helped by a technical Committee in choosing the types of machine, etc.

The staff (foremen, mechanics, drivers), chosen by the War Ministry from among the soldiers, is trained in two special schools, one at Rome, the other at Foggia.

The work is divided among units of 10 tractors each. Each unit has a foreman, an assistant, 4 to 10 mechanics, 20 to 26 drivers and 2 labourers. Each unit has its own deposit and lodgings for the men, as well as everything required for independent working.

A number of units form a centre of motoculture, commanded under military law by a centre commander. Each centre has an office stores, and a workshop for big repairs.

The units consists of tractors suitable for the locality where they work. The State owns numerous types of tractors of a power varying from a minimum of 8-16 HP. to a maximum of 30-40 HP. Besides ploughs the units are provided with harrows, rollers, drills and binders.

Farmers wishing to benefit from State motoculture, apply through the local delegates, paying a certain fee per acre.

302—*Agricultural Tractors in the United States, in 1918.*—*Farm Implement News*, Vol. XXXIX, No. 11, pp. 38-66 + 1 Table + 1 Fig. Chicago, March 4, 1918.

A description, with many illustrations, of 161 tractors made by

104 American firms, giving the chief characteristics and noteworthy details of the construction:—size; number of driving and steering wheels, or if on chaintrack system; H.P.; draw-bar pull; speeds; number of ploughs that can be hauled; size of thresher that can be driven; engine; cylinders and bore; stroke; carburettor; ignition; pumps; drive; shaft-speed; fuels that can be used; tank capacity; total weight; works price at date of publication and liable to alteration without previous notice. The characters of the 101 tractors described in the text are summarized in table form.

803 — **Traction on Bad Roads or Land.** — LEGROS, L. A., in *Engineering*, Vol. CV, Nos. 2717, 2718, 2719, 2720, 2721, 2722, 163 Figs., 2 Tables + an Historical and a Bibliographical Appendix. London, January 25 to March 1, 1918.

The author deals with the problems involved in the design of vehicles for hauling goods or agricultural implements over the land or bad roads. He chiefly deals with tractors having more than 2 driving wheels or provided with a chain track. These two classes of tractor are applicable to different conditions, and while the methods cannot be considered as competitive, the limitations of each can be best appreciated by direct comparison of their respective peculiarities and advantages.

In the first part the author, while considering various types, deals successively with four wheel driving, four-wheel steering, four-wheel braking, automatic differential locking gears, and the application of the four driving wheels for bad roads and arable land. Comparative figures for the different types of vehicle, their horse-power, speeds, load weight, wheel base, track width, turning radius, and overall dimensions are given by the author in a table.

The author concludes that for the transport of goods over bad roads on gradients varying from 1 in 15 on roads in which the tyres sink 2 in. to 3 in. in depth to 1 in. 5 on hard roads with bad surface, and for speeds varying from 1.5 m. p. h. on grades to 12 m. p. h. on fairly level roads, the four-wheel drive tractor has great advantages over the ordinary two-wheel drive tractor.

In the author's opinion it may be expected to rank as an important factor in the development of districts overseas not far removed from railroads, but having only primitive roads.

In part 2 of the paper chain-track tractors are dealt with and classified. The author considers methods of springing, truck frames and track-frame connections, steering, driving gear, engines, ignition and starting, radiators, speed, draw-bar pull, climbing power, etc., and he describes various English, American and French tractors, the various types being shown in illustrations. Chain-track tractors have been built in the U. S. A. and used for hauling logs since 1904, some of the original ones being still in use; these machines have intermediate roller chains ("Phoenix", ALLIS-CHALMERS, and DIPLOCK). The author gives, in a second table, a summary of the various chain-track tractors, afterwards giving details of their construction.

The tractors described are: —

The Log-Hauler, Phoenix, of 100 H.P.; the Centiped Truck, Phoenix,

of 50 H.P.; the 68 H.P. ALLIS-CHALMERS tractor; the HOLT Caterpillar tractors of 18, 45, 75 and 120 H.P.; the CLAYTON tractors (1) of 35 and 110 H.P.; the Tracklayer (C. L. BEST) of 16, 30, 75 and 90 H.P.; the Creeping-Grip tractors (BULLOCK) (2) including the 75 H.P. Giant, the 50 H.P. Senior, the 30 H.P. Junior, and the 16 H.P. Baby; the 15 and 35 H.P. AUSTIN tractors; the 25 and 50 H.P. STRAIT (KILLEN-STRAIT) tractors; the 25 H.P. MARTIN's agricultural tractor (3); the 30 and 40 H.P. Lefèvre (4) tractor; the 12 H.P. WORSELEY motor sleigh.

The author gives numerous examples of the use of chain-track tractors for ploughing and for transport on bad roads unsuited for the conveyance of heavy loads. He calculates that the cost of traction is  $\frac{1}{3}$  to  $\frac{1}{5}$  that by means of horses or mules. Besides their use for cultivation and road haulage, the author mentions the use of chain-track tractors for excavating drainage trenches (5); amongst these, the PARSONS excavators (20, 30, 45, 62 and 80 H.P.) and AUSTIN excavators (15 to 85 H.P.) are described.

The author concludes that where a track can be found 7 ft. wide which does not present rocky obstacles over to in. high, whether over sand, ash, clay, marsh, snow or ice, on the level, or on gradients up to 30 per cent., the chain track tractor has proved itself capable of travelling and performing useful work beyond the capacity of animal haulage. For this reason the chain-track tractor may be expected to occupy a position of ever-increasing importance in the development of new countries and in places where it is necessary to transport machinery and stores over roadless country many miles from the railway. Mr. LEGROS does not regard any one of the existing systems as perfect and expects that much will be done to improve the vehicles in the near future.

There is probably room for considerable improvement in the chain-track itself as well as in its supports and its anti-friction devices. The variation in resistance to haulage is so great as between one system and another, not merely in static resistance to starting, but in dynamic resistance to haulage, that, as the author has already suggested, the various track systems should form the subject of comparative tests at some of the great agricultural colleges. One feature that is particularly remarkable is the small amount of power lost in compressing soft marshy land under the feet of the track chains.

**804 - The Ford Tractor (6) and the Oliver M. O. M. Plough in England.** - *The Journal of the Board of Agriculture*, Vol. XXIV, No. 12, pp. 1456-1457. London, March, 1918.

In the Letter No. 79/M. 1, dated February 26, 1918, the Food Production Department of the Board says that is essential that the Ford tractor should be used only with the new type Oliver M. O. M. plough which was specially designed to work with it, and which is supplied with each Ford tractor. The tractor and plough together form a unit, and on no account must this tractor be used with any other type of plough.

(1) See *R.* 1918, No. 678; — (2) See *B.* 1915, No. 1012; — (3) See *R.* 1917, No. 678; — (4) See *R.* August, 1917, No. 753; — (5) See *R.* 1917, No. 1051; — (6) See *R.*, 1917, No. 755. (Ed.)

The new Oliver plough is giving great satisfaction for both grass and stubble ploughing.

According to trials carried out on the farm of the Harper Adams Agricultural College in February, 1918, the Ford tractor and the new Oliver plough gave good results in breaking up a grass field not previously ploughed for about 20 years. The special features of the Ford tractor are:—extreme accessibility of the engine parts; reduction of the lubrication parts to 11 oil-holes and grease-cups; the possibility of turning in a minimum space; direct attachment of the plough to the tractor; only one operator is required, the control levers of the plough being easily accessible to the tractor driver from his seat. As regards the Oliver plough the outlift at the end of the furrow is automatic, and the depth at which the plough is working can be easily regulated.

The plough has a skin coulter that turns in the upper layer of the turf, and at the same time keeps clean the surface of a swivel disc coulter replacing the usual knife-form of coulter. The mouldboards are well shaped and turn the furrow slice satisfactorily to a good depth. A depth of 8-9 in. was maintained satisfactory on level ground, second speed being used on the tractor. The mouldboard is of a type and setting unusual in England. Longitudinally it is concave, and transversely convex, while it is set out at an angle of 45°. The work done by the plough resembles that of fallow land ploughed with a digging plough. The land is left very light, and it is obvious that the ploughing must be followed by a discing to secure the necessary compactness, but an abundance of loose mould is produced which is not the case with the older system of ploughing. The character of lea ploughing produced is revolutionary, but there is every reason to anticipate that this type will be superior to the type of ploughing generally adopted.

805 - Disc-Harrow Trials at Montpellier, France.—CIAROU, C., in *Le Progrès Agricole et Viticole*, Year XXXIX, No. 15, pp. 347-350, 3 Figs. Villefranche, April 14, 1918.

Disc-harrows were introduced into France a long time ago, and they are now much in favour as they are of great interest to farmers and southern winegrowers.

The author gives the results of trials that he carried out at the Montpellier School of Agriculture with the disc-harrow under widely different conditions. The trials were made a "Cotton" 6-disc harrow, supplied by the firm of BOMPARD, at Montpellier. The machine is 49 in. wide, 28 in. high without the seat, 51 in. long without the shaft, and 14 ft. with the shaft. Its total weight is about 660 lb.; the discs are 17.32 in. in diameter.

The machine was tested in a vineyard. But owing to its dimensions, and the space required for the team, it can only be used where there is at least a space of 79 in. between the vines; space is also necessary to allow for turning at the end of each row.

1) *Trial at Mas de Rochel (near Castelnau) February 23.*—The harrow worked in a recently-ploughed sandy soil at its maximum depth of 4 to 5 in. on the first turn. There was no weight on the machine, as the

"Cotton" harrow has no arrangement to allow of this. The work was done along the furrow slice and was well done. Cultivation was not necessary as the soil was already well broken up.

2) *Trial at Mœstroun (Farm of the School of Agriculture at Montpellier), March 7.* — The Mœstroun vineyard had not yet been ploughed and the harrow turned the soil under; its work was comparable with that of an ordinary vineyard hoe. The ground was sloping; during the descent the discs did not enter the soil sufficiently, while in ascending the work was good. The tilth obtained with the pulveriser in the first turn was the same as that given by the hoe. After the first turn the pulveriser worked more deeply than the hoe. The depth was 3 in. during the first turn. The work was hard on the horses. A one horse hoe passes among all the vines, but the harrow hauled by 2 horses requires 6 ft. 6 in. between the vines.

The great advantage of the pulveriser is that, in passing twice over the same ground, it would replace the plough; and that in two turns it does sufficient work almost equal to 6 furrows of the plough. In addition the grass was destroyed much better than with the hoe.

3) *Trials at Mandou (Land near the School of Agriculture at Montpellier), March 6.* — The soil was loamy, with abundance of couch-grass, and had already been ploughed and cultivated. The harrow did not destroy the couch-grass very satisfactorily. The spring-time harrow had given much better results. Another turn with the plough would probably have been much more useful.

At Mandou the harrow was coupled to a 5-10 HP. Avery tractor, a dynamometer being placed between to register the draught of the one and the power of the other. A width of 47 in. was cultivated at each turn. The results of the trials are given in the following table.

*Comparative draught of a disc-harrow and a spring-line cultivator.*

Depth metres	Disc-harrow				Cultivator				
	Type of work done	Tractive effort		Type of work done	Tractive effort		Type of work done	Tractive effort	
		in kg.	per metre (t)		in kg.	per metre (t)		in kg.	per metre (t)
0.02	Incomplete	130	110				115	115	
0.03	Incomplete	160	130				125	125	
0.04	Good	200	160	Good scratching			150	150	
0.6	Does not break soil up . . . . .	225	185	Excellent work			200	200	

(1) Tractive effort per metre of width worked.

It will be seen from this table that at equal depths the draught of the 2 machines is practically the same; but the machines are not made

to work at the same depth. If the harrow goes deeper than 5 cm., it does not work well at all.

4) *Test at Bellevue (Commune of Montpellier), March 8.* — Field spring and autumn-ploughed; compact, damp soil, with occasional big clods left by deep ploughing and untouched by other hoe or roller.

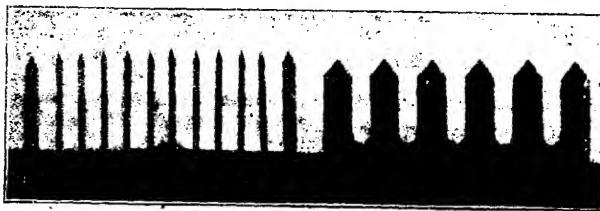
The most suitable average depth was found to be 6 cm. for the pulveriser. The work was not too heavy for the horses; in 80 minutes 0.4 hectare was worked; which is equivalent to 3  $\frac{1}{2}$  hours per hectare. Normally, 2 to 3 hectares could be done a day. The results obtained were the best of the 4 trials.

The model tested was not suited for vineyard work, as a 6-disc harrow requires 2 horses. This prevents the use of the machine in vineyards having less than 6 ft. 6 in. between the rows. It is, however, very suitable in new vineyards with a width of from 6 ft. 6 in. to 7 ft. 4 in.; 8-disc harrows might even be used, and with vines on iron wire, even 10-disc harrows. The author considers that the harrow is interesting and that, used at the right moment under suitable conditions, it might be of great service to farmers for destroying weeds, etc.

806 — **A Weeding Rake for Low Vines.** — SAVASTANO, L., in *R. Stazione sperimentale di Agricoltura e Frutticoltura, Acireale, Bollettino No. 34*, pp. 1-2 + 1 Fig. Acireale, April, 1918.

The author has invented this tool so that women and children can weed low vines more easily in summer.

*Weeding rake for low vines.*



If, instead of using the hoe, an ordinary rake is used, many of the weeds are removed, but those with tap roots remain with the root intact, so that they quickly grow again. To avoid this, the two end teeth of the rake have been modified by making them like a knife blade with an external cutting edge. The dimensions are: — length of blade 14 in.; length of teeth 5 in.; length of handle about 5 ft. so inclined to the blade that no stooping is required when using the rake. When a tap-rooted plant comes under the rake, the tool is lifted and the root struck with the blade.

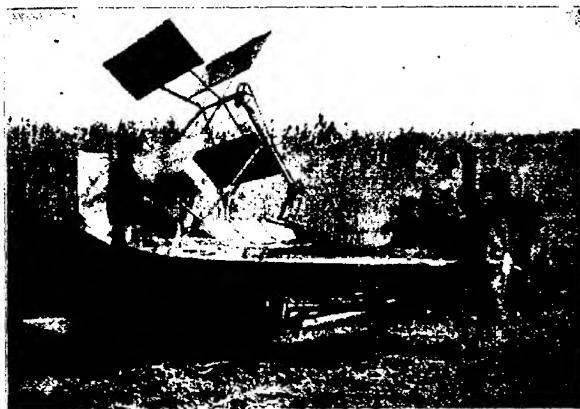
Of the 2 types of rake shown on the figure by the letters *A* and *B*, the first has broad, flat teeth, and the second round or, better still, square teeth. One or the other is used according to the kind of soil.

807 - **Economic Advantages Resulting from the Use of Machinery in Harvesting Wheat.** — See No. 812 of this Review.

808 - **A Hemp Harvester.** — *The Implement and Machinery Review*, Vol. XI, III, No. 516, p. 1291, 1 Fig. London, April 1, 1918.

This harvester is made by the INTERNATIONAL HARVESTER CORPORATION, Chicago, U. S. A., being devised with idea of enabling hemp to be grown on a large scale notably for the manufacture of binder twine. In 1917, the Ridge Land & Navigation Co., of Stockton, California, raised 4,000 acres of hemp and handled the whole crop by machinery.

This hemp harvester is of necessity much larger and heavier than a grain binder, for hemp may grow from 6 to 9 ft. high. Hemp of this height is most desirable and produces the best fibre. Because the hemp grows so high a wider platform has to be provided and the reel has to be much higher and fitted with special fans. A heavy knife, with special guards, is also essential.



Hemp harvester.

In order that the hemp may be spread on the ground so as to ret properly, and so that each swath may be moved out of the way of the horses and harvester on the next round, the hemp is moved to the right and placed down at right angles to the machine. A circular carrier accomplishes this, as shown in the appended illustration, the mechanism laying the hemp in a nearly straight line, and at almost perfect right angles to the harvester.

The retting of hemp requires from 2 to 3 weeks to 2 or 3 months, depending on the humidity and the temperature. Three machines are required to complete the cycle of harvesting hemp and producing the fibre. When the retting is complete the hemp binder picks up the hemp and ties it into bundles, which are shocked similarly to maize, with the difference that the shocks are made more open to permit a free circulation of air. When the shocked hemp is ready, it is taken to the braker, from which it passes to the scutcher.

809 - Review of Patents.

TILLAGE MACHINES AND IMPLEMENTS. — *Italy*: 158480 Rotary motor-plough; 159764 Rotary plough.

*United Kingdom*: 113684 Agricultural skimmer plough; 114028 One way motor plough.

*United States*: 1258109 Rotary cultivator; 1258286 Multiple disc plough for mechanical traction; 1258287. Disc cultivator attachment; 1258681 Plough; 1258951 Lister plough; 1259174 Agricultural implement frame; 1259511 Power lift tractor lister; 1259638 Traction plough; 1260079 Cultivator; 1260318 Harrow; 1260497 Disc harrow; 1260573 Landroller; 1260738 Power propelled agricultural machine; 1260752 Plough coulter.

DRAINAGE AND IRRIGATION. — *Switzerland*: 77759 Drainage pipe.

*United States*: 1258240 Irrigation water elevating device; 1258759-1259746 Ditch or drain forming device; 1259211 Irrigation apparatus; 1259684 Drainage pipe.

MANURES AND MANURE DISTRIBUTORS. — *France*: 486840. Physiological manure composed of the plant's natural salts for directly and locally fertilizing any agricultural seed or plant.

*United Kingdom*: 113571 Process and apparatus for producing a nitrogenous manure from straw or other material containing fermentable carbohydrates by fixation of atmospheric nitrogen; 1136448 Process for producing calcium superphosphate.

*United States*: 1258378 Straw spreader; 1259456 Harvesting and reduction apparatus for sea kelp; 1259457 Kelp incinerator; 1259731 Spreader; 1260219 Fertilizer spreader; 1260332 Combined cultivator and fertilizer distributor; 1260777 Apparatus for distributing fertilizers.

DRILLS AND SEEDING MACHINES. — *Netherlands*: 2378 Bulb planter.

*United States*: 1259033 Seed planting attachment for cultivators; 1260174 Ridging attachment for planters; 1260808 Planter.

VARIOUS CULTURAL OPERATIONS. — *France*: 486641 New system of cultivation.

*United States*: 1258085-1259940 Cultivators; 1258275 Portable machine for fastening vines to supports; 1258340 Cotton chopper; 1258680 Wheeled cultivator; 1260332 Combined cultivator and fertilizer distributor; 1260741 Sugar cane cultivator.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *France*: 486556 Regulator for dusting and similar machines.

*Switzerland* : 77763 Process for manufacturing a product for destroying pests.

*United States* : 1258504 Insect catcher; 1258930 Quack-grass destroyer.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *France* : 486735 Improved motor-binder.

*Italy* : 159363 Lifter for harvesting lodged cereals.

*Switzerland* : 77881 Fruit picker.

*United Kingdom* : 114082 Flax pulling machine.

*United States* : 1257972-1259767 Maize harvesters; 1258277 Cotton picker; 1258671 Chain sickle mower; 1259465 Reaper; 1259647 Shock binder; 1259803 Self cleaning rake; 1260031 Gang mower; 1260410 Butt adjuster for maize harvester; 1260906 Rake.

MACHINES FOR LIFTING ROOT CROPS. — *United States* : 1258456-1258818-1260715 Beet topping machines; 1258819 Beet digging machine; 1259178 Beet harvester.

THRESHING AND WINNOWING MACHINES. — *United States* : 1258354 Separator; 1258858 Forced straw stacker for threshing machine; 1260014 Band cutter and feeder for threshing machine; 1260227 Grain separator.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *France* : 486822 Fodder loader.

*Italy* : 160096 Improvement to machines for grinding cereals, oats, chestnuts, etc.

*Netherlands* : 2371 Latex coagulating apparatus.

*Switzerland* : 77880 Process and apparatus for ventilating haystacks.

*United Kingdom* : 113700 Apparatus for packing grains, etc.

*United States* : 1258125-1259678 Peanut shellers; 1258142 Shock loader; 1258217 Seed maize drier; 1258245 Pepper peeling machine; 1258848-1259961 Baling presses; 1258958 Fruit sizing machine; 1259034 Attachment for gin-feeder; 1259081 Variable speed drive mechanism for cotton gin; 1259613 Fruit packing press; 1259905 Fruit and melon grader; 1260059 Beet loading machine.

FORESTRY. — *France* : 486895 Heath grubbing machine for animal traction.

*Switzerland* : 77761 Plant for cutting and bundling twigs.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *France* : 486651 Motor-windlass car; 486767 Tandem tractor.

*Italy* : 156674 Driving wheel for tractor and motorplough.

*United Kingdom* : 113407-114100 Power cultivation of land (battage by cables).

*United States* : 1257976 Power attachment for automobiles; 1257999 Farm and road tractor conversion attachment; 1258221-1258302-1258512-1258973-1260259 Tractors; 1258288 Chain track drive and support for tractor; 1258329 Truck for converting an autocar into a tractor; 1258489 Tractor gearing; 1258501 Tractor wheel rim; 1258502 Agricultural tractor; 1258601-1258612-1258613 Track chains; 1258602-1258605 Endless trackbelt tractors; 1258603 Traction engine with a pair of endless tracks and one steering wheel; 1258607 Wheel for tractor truck

mechanism; 1258608 Track link construction; 1258611 Support for chain track; 1260402 3-horse draft equalizer.

FEEDING AND HOUSING OF LIVESTOCK. — *Italy*: 159264 Liquid, concentrated or solid animalized vegetable milk for rearing stock.

*United Kingdom*: 113988-114115 Horseshoes.

*United States*: 1259071 Hay distributor; 1259084 Calf feeder; 1259112 Hog trough; 1260339 Fly catcher for stables and barns.

POULTRY FARMING. — *United States*: 1258037-1259726 Incubators; 1258069 Mechanism for feeding device.

FISHING. — *United States*: 1258213 Fish hook.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Italy*: 159569 Bolt-ing machine drive.

*Netherlands*: 2427 Improvement to sugar cane crushers.

*Switzerland*: 77926 Hand mill with two superimposed plates for treating fruit stones.

*United Kingdom*: 113486 Bakers' yeast; 113530 Apparatus for extracting oils from seeds, etc., by solvents; 113558 Conveyor for mechanical bread making; 113628 Rotary filtering drum for pressing yeast; 113697 Process for reduction of grain in view of increasing the yield of flour from wheat and other cereals; 114024 Apparatus for depericarping palm nuts, olives, etc.

*United States*: 1258571 Apparatus for decorticating, washing and drying sisal and other fibrous materials; 1258866 Machine for working dough or other plastic substances; 1258981 Fruit juice extractor; 1259213 Fruit slicing machine; 1259483 Milk substitute composed of edible oil, flour, glucose, salt and water; 1259774 Apparatus for drying tomatoes and fruit; 1260053 Fruit press; 1260399 vegetable slicing machine.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *Italy*: 159839. Process and apparatus for the rapid tanning of skins.

DAIRYING. — *United States*: 1258036 Milkcan; 1258095 Churn-dasher; 1258902 Milk sterilizer; 1258996 Method of making composition butter; 1258997 Artificial butter composed of cream and condensed skimmed milk; 1259047 Ventilating cream can cover; 1259323 Combined stool and milk pail; 1260127 Milk pasteurizer.

FARM BUILDINGS AND EQUIPMENT. — *Italy*: 159799 Bottom drained MARIANECCHI silo for storing sugar beet pulp.

*United States*: 1259021 Grain elevator structure; 1259039 Farm gate; 1259080 Portable shelter.

VARIOUS. — *United States*: 1258048 Orchard-ladder on truck; 1258198 Adjustable horse collar; 1259055 Horse collar; 1259239 Orchard ladder; 1259669 Soil testing machine.

810 — **Movable Pig-Houses.** — I. EDWARD J. M. and DAVIDSON J. B., extracted from *Iowa Agricultural Experiment Station, Iowa State College of Agriculture and the Mechanical Arts, Bulletin No. 152, Ames, Iowa, U. S. A.*, published in *Missouri State Board of Agriculture Monthly Bulletin*; Vol. XIV, No. 5, pp. 51 + 37 Figs. + 2 Tables, Columbia, Missouri, May, 1916. — II. MACVEAN, J. D. and HUTTON, R. E., in *U. S. Dept. of Agriculture, Office of the Secretary, Circular No. 102*, pp. 8 + 6 Figs. Washington, February, 1918.

I. — Movable pig-houses of suitable construction are of great use if

they are adapted to local conditions. The model pig-houses described in the bulletin under consideration were tested at the Iowa agricultural experiment station. These pig-houses are practical and based on long study of pig-rearing in the United States.

After describing the requirements for the site and the construction of pig-houses, the authors give the advantages and disadvantages of pig-houses consisting of single, isolated and portable sties as compared with central permanent piggeries containing many sties with or without movable partitions. Among the advantages claimed for single-sty pig-houses each containing a sow and her litter, are :—

- 1) the ease with which the house may be taken down and moved about to suit the needs of the farm;
- 2) the rapid isolation either for sows about to farrow, for protecting the young, or for the growth of young pigs, and for selection;
- 3) improved sanitary conditions, both for the prevention of disease and rotation of pasture;
- 4) simplicity of construction.

These pig-houses are more practical and cheaper for beginners or breeders on a small scale, and they are more suitable to farming conditions, being portable. A limited number of the houses can be warmed with oil-lamps, and the risk of fire is less. The single-sty, portable pig-house combines perfectly with permanent piggeries by acting, when required, as a supplement to the latter. Amongst the disadvantages, it should be noted that :—

more labour and time is required for tending the herd as the houses are scattered about ; they do not last as long ; it is difficult to heat many houses at the same time ; the lighting and ventilation are imperfect ; the manure is often not removed on account of the distance between the sties ; the care, feeding and watering are more difficult.

A larger number of types of portable pig-house have been constructed by the live-stock and farm engineering departments. Many of them only differ as regards the placing of the doors and the provision of hinged walls to serve as shelter, ventilators and windows.

The authors describe the various types, giving plans and estimates for the 6 chief single pig-houses tested.

Among these the "Iowa Gable Roof House" was used successfully by the Iowa agricultural experiment Station. As is shown in fig. I, it is of simple construction ; its vertical walls can be lifted up, thus giving a greater area for shelter ; one of the sides of the roof, which should face either to the east or south, has two flaps which open or close like a door, so as to uncover or cover two glazed windows. The entrance can be either in front or at the side. The frame and walls are of wood ; there is a floor of 2 in. planks, but this can be omitted if the site is sufficiently dry.

The construction of the house is shown in a design, the various dimensions being given. It is about 9ft. long, 7ft. wide and 4ft. 6 in. high to the ridge. In Iowa the wood and labour required cost \$ 8.44.

Figure 2 shows the "A" pig-house, so-called from its resemblance to

that letter. The sides have a hinged division that can be lifted up to give shade in summer. In another "A" type of pig-house one of the sides has a leaf that can serve as a door.



Fig. I. - Iowa gable roof house (spring and autumn).

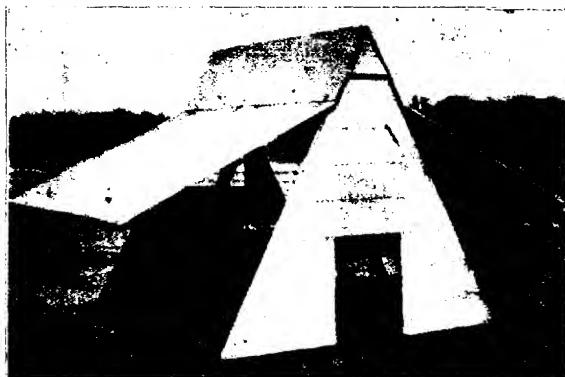


Fig. II. - "A" house with lateral flaps (summer).

The "A" pig-house is of simple construction and can be erected very quickly. It is highly favoured by a large number of breeds. It is made in varying sizes, the one illustrated being 9ft. long, 7ft. wide at the base and

6 ft. 6 in. high to the ridge. The doors may be placed so as best to suit local conditions. On the side opposite to the door is a ventilator, which may be opened or closed according to the weather. This type is made of wood and costs about the same (\$8.94) as the Iowa gable roof house. The ever-increasing cost of wood has led to the construction of type "A" pig-houses in metal. The experience obtained under Iowa conditions show that the metal houses are warmer at noon and colder at night than the wooden houses.

II. — Portable pig-houses which can be taken to pieces are of great use especially in regions having mild winters and serve to shelter the pigs against both the summer sun and winter damp and storms. These single pig-houses can be moved from one pasture to another when the pigs are changed to fresh pasture.

These shelter-houses form an important factor in the development of pig breeding, for they are suitable for housing the spring litters and are cheaper than larger buildings. The circular contains instructions, figures and plans for building 2 ordinary types of portable, single pig-house. The type "A", is about 8 ft. wide at the base and 6 ft. long and the lateral flaps that forms the gables are 8 ft. long.

The type "A" is very suitable for fattening spring pigs, or for housing a sow and her litter in warmer climates. In cold regions where it snows and there is much wind, the house should be made as warm as possible by covering it with tarred paper. This is especially necessary in the north if the house is to be used for farrowing. The interior heat may be conserved by covering the house with straw, leaves, etc. In hard weather, a couple of lamps could be lit and hung from the roof of the house.

#### RURAL ECONOMICS.

**11 — Important Factors in the Operation of Irrigated Farms in Utah, U. S. A. —**  
BROSSARD, E. B., in the *Utah Agricultural College Experiment Station Bulletin No. 164*,  
pp. 48, 49 Tables, 16 Figs. Logan, September, 1917.

In order to promote the maximum economic agricultural production of existing farms and the agricultural development of many thousands of acres of new land, the Utah Agricultural College, in collaboration with the U. S. Dept. of Agriculture, has carried out an inquiry to determine, according to the experience of practical farmers, the most profitable systems of farm management on irrigated Utah farms and which can be applied by those wishing to obtain farms in Utah, and also to furnish bankers, officers of loan associations, and other capitalists who loan money on irrigated farms in Utah useful information regarding the average value of such securities. The inquiry is based on records from 309 irrigated Utah farms for 1914. The records were taken in 7 typical general farming areas in 7 typical counties of Utah. The climate, crop, and livestock conditions in Utah in 1914 were about normal.

The following facts were brought out by this investigation —

I. — **FARM CAPITAL.** — 1) A greater percentage of the capital is di-

rectly productive on farms with large capital than on farms with small capital.

2) There is less waste land in proportion to the total farm area on the farms with large capital.

3) A large farm capital is usually accompanied by a greater number of acres and crop acres. The proportionate area cropped is about constant.

4) On the average, crop yields are a trifle better on farms which have a large capital. This seems true, however, only when farm capital is less than \$ 20 000.

5) A large farm capital is usually accompanied by large numbers of productive animal units.

6) The farms with large capital are usually the most intensely stocked.

7) A large farm capital is usually accompanied by a comparatively high value per acre of land and buildings.

8) A large farm capital is on the average accompanied by a decrease in the value of machinery per crop acre, and by an increase in the number of crop acres per \$ 100 worth of machinery.

9) Horse labour is more efficient on the farms with large capital.

10) When the same farm crops are raised man labour on crops is more efficient on farms with large capital than on farms with small capital.

11) When approximately the same kind of livestock is kept, man labour with livestock is more efficient on farms with large capital than on farms with small capital.

12) Farms with large capital have more capital per man than farms with small capital.

13) As a result of the foregoing economies, farms with large capital are more profitable than farms with small capital, as shown by the increase in the farmers' labour income.

14) The total net income from the average of 309 irrigated Utah farms was about as follows, in 1914:—

5 % interest on average capital of \$ 11 886. . . . .	\$ 594
Average farmer's labour income . . . . .	\$ 541
Value of farm products consumed by average farm family . . . . .	\$ 600
11.625 % of \$ 7482, increase in value of average irrigated farm land on 309 irrigated Utah farms, 1914. . . . .	\$ 870
Total net income . . . . .	\$ 2 605

15) Labour income is less in proportion to farm capital on farms with large capital than on farms with small capital.

16) Labour income increases in the same ratio as farm capital until farm capital reaches \$ 20 000 or over. Beyond this, as capital increases 1 %, labour income increases only about 0.33 %.

II. — SIZE OF FARM — 1) There are more acres of crops, on the average on the large farms than on the small farms. But, the proportionate area cropped is less on the large farms than on the small farms.

- 2) A larger percentage of the farm capital is employed in directly productive enterprises on the large farms than on the small ones.
- 3) The shelter cost per unit of livestock is lower on the large farms than on the small farms.
- 4) Each \$ 100 worth of machinery is more efficient on the large farms in that it cultivates more acres of the same kind of crops and consequently lessens the value of machinery per crop acre.
- 5) Horse labour with crops and livestock is more efficient on the large farms.
- 6) Man labour with crops and livestock is more efficient on the large farms.
- 7) As a result of the foregoing economies on the large farms, they are more profitable as shown by the greater size of the farmer's labour income. This is \$ 336 for farms of from 10-39 acres and rises as the size of farm increases till it attains \$ 991 for farms of from 300-500 acres.
- 8) The farmer's labour income is less in proportion to the total farm capital on the large farms than on the small farms.
- 9) Over half of the labour income from the average irrigated Utah farm is increase in inventory of farm capital. The most important increases in the farm inventories are in livestock and feed. This seems to indicate that Utah farmers realise the advantage of increasing the number of livestock on their farms.

III. — OTHER IMPORTANT FACTORS. — 1) On an average the farms with the highest crop yields per acre are the most profitable.

- 2) When average crop yields are maintained, the size of the irrigated Utah farm influences the labour income of the farmer more than increased crop yields per acre.
- 3) The number of livestock and the net livestock receipts per productive animal unit affect directly the farmer's labour income — as either increases the farmer's labour income increases. Both are important factors in the operation of irrigated Utah farms.

812 — Cost of Harvesting Wheat by Different Methods in the United States. — *YERKES, A. P. and CRUCET, J. M.* in U. S. Dept. of Agric. *Bulletin No. 627* (Office of Farm Management), pp. 1-24. Washington, D. C., February 13, 1918.

By far the largest percentage of the wheat of the United States is to-day harvested with the binder, the use of this machine being almost universal. The only wheat-growing sections where the binder is not used on the greater part of the crop are in the States of Washington, Oregon, and California and parts of Idaho, Utah, Wyoming and Montana, where much of the wheat is cut and thrashed with combined harvesters although even where these outfits are commonly used binders also are employed to some extent.

The cost of harvesting may be somewhat greater where the binder is used than where the work is done with headers or combined harvesters. The binder, however, has a distinct advantage over these machines in that the work of harvesting may be begun from one to two weeks earlier with the binder than with either the header or combine, since wheat can be cut with a binder while in the early dough stage and placed in shocks to

complete ripening, thus requiring fewer horses and men to harvest a given acreage. The cost of harvesting wheat with a binder varies considerably being influenced by several factors, *i. e.*, size of the outfit used, yield per acre, especially of the straw, the character of the soil, whether soft or firm, rough or smooth and the topography of the farm, whether level or hilly, the working ability of the horses used and the condition of the working parts of the machine. The figures given in Table I approximate the average conditions as far as possible, assuming man-labour to be worth \$2 per day and horse-labour \$1.20 per day.

TABLE I. — *Average acres cut by 6, 7 and 8 foot binders in a 10 hour day (235 Reports) and labour cost of cutting one acre of wheat with binders of different sizes.*

Width of cut and number of horses	Acres cut			Cost per acre		
	per binder	per horse	per foot of cutter bar	total labour	man labour	horse labour
6 foot, 3 horses . . . . .	10.90	3.63	1.82	0.51	0.18	0.33
6 foot, 4 horses . . . . .	12.10	3.03	2.02	0.57	0.17	0.40
7 foot, 3 horses . . . . .	12.50	4.17	1.79	0.45	0.16	0.29
7 foot, 4 horses . . . . .	15.10	3.78	2.16	0.45	0.13	0.32
8 foot, 4 horses . . . . .	17.00	4.25	2.13	0.40	0.12	0.28

*Interest and Depreciation.* — The cost for interest and depreciation on binders, based on tabulation of 235 Reports, was \$0.24, 0.16 and 0.125 per acre annually, for the 6, 7 and 8 foot binders respectively with a life of the binders of 15, 11 and 10 years and 750, 1100 and 1500 acres respectively.

The acres cut annually by a binder do not seem to have a very direct influence upon its life except where the acreage is extremely large. There is a certain deterioration due to age which appears to limit the length of life in years whether the binder does a fair amount of work each season or not.

*Repairs.* — Many farmers have reported the use of a binder for several years without a cent being spent for repairs, whereas in other cases repairs have ranged from \$10 to \$15 annually. As a rule the most expensive item of repairs is the canvas. If properly protected when idle, a binder canvas should cut from 400 to 800 acres. It is believed that 20 per cent. of the first cost for six-foot binders, 25 per cent. for seven-foot and 30 per cent. for eight-foot machines will approximate the average repairs required for these outfits.

The cost for shelter has been omitted because this item varies so greatly and in many cases is insignificant, since a great many binders, particularly in the West, have no shelter whatever except for the canvasses and sickles, which usually are taken off and stored in a dry place during the winter.

*Auxiliary Binder Engines.* — The use of binder engines furnishing power to operate the mechanism, which is ordinarily driven by power from

the horses through the medium of the bull wheel, has increased considerably during the last two or three seasons particularly in certain sections where wet ground has made the operation of the binder difficult. These engines cost about \$150 but their use is not confined to the binder alone, being utilized for belt power. Under these conditions their estimated average life is about  $9 \frac{1}{2}$  years. In some instances the engines are used practically every day of the year for pumping water, except while on the binder.

The owners of these outfits report that from 2 to 5 gallons of gasoline are required to operate the engine per day, while about 1 pint of lubricating oil per day appears to be a fair average. With gasoline at 20 cents per gallon and lubricating oil at 40 cents this would make the daily operating expense about 85 cents. Reports from farmers indicate that an increase of from 4 to 5 acres per day may be expected in the area covered with the binder under unfavourable conditions previously mentioned. The repairs on the outfits averaged \$3 annually.

*Shocking.* — The practice of shocking wheat after being cut with a binder is almost universal. The average acres shocked per day per man and cost per acre and per bushel in relation to yield per acre are shown in Table II.

TABLE II. — *Acres shocked per day per man and cost per acre and per bushel in relation to yield per acre (Based on labour at \$2 per day, 264 Reports).*

Yield per acre	Average yield per acre	Acres shocked per day man	Cost per acre	Cost per bushel
Under 20 bushels . . . . .	15	12 $\frac{1}{2}$	\$ 0.16	\$ 0.01
20 bushels . . . . .	20	12	0.16 $\frac{1}{2}$	0.008
21 to 30 bushels . . . . .	20.2	8 $\frac{3}{4}$	0.23	0.009
31 bushels and over. . . . .	37.4	7 $\frac{1}{2}$	0.26 $\frac{1}{2}$	0.007

*Comparison of Costs — Old methods versus new.* — It is very interesting to compare the costs of cutting wheat as it is usually done to-day, with the methods in use 75 years ago, according to the *Transactions of the New York State Agricultural Society* (Vol. 10, 1850). Based on labour at \$2 per day, the cost per acre by the hand method, with an average yield of 16 bushels per acre, would have been approximately \$1.60 75 years ago as against \$1.23 with the binder. But to-day two men (one shocking) with three or four horses will cut, bind and shock about eight times as much wheat as two men cutting with a cradle and binding by hand. Taking wheat prices and labour prices into consideration, the cost of harvesting in recent years has represented about one eleventh of the selling price of the crop, whereas in 1850, when hand methods were used, the cost of harvesting represented less than one thirtieth of the selling price.

*Stacking.* — Six acres per day for two men and one team appears to be a fair day's work in stacking wheat under most eastern conditions, whereas in the western sections, where the more efficient methods are employed,

8 acres per day for two men and two horses and 10 acres per day for two men and four horses would appear to be a fair average. Based on these figures the cost of stacking per acre for man and horse-labour would be as shown in Table III.

TABLE III. — *Labour cost per acre and per bushel of stacking wheat with man-labour at \$ 2 and horse-labour at \$ 1.20 per day of 10 hours.*

Operation — No. of horses	Acres covered per day	Labour cost per acre			Cost per bushel (16 bushel yield)
		Man	Horse	Total	
1 man pitching and 1 loading (1 wagon) 2 . . . . .	6	\$ 0.66 1/2	\$ 0.40	\$ 1.06 1/2	\$ 0.06 1/2
2 men pitching (1 wagon) 2 . . . . .	8	0.50	0.30	0.80	0.05
2 men pitching (2 wagons) 4 . . . . .	10	0.49	0.48	0.88	0.05 1/2

TABLE IV. — *Cost of harvesting an acre of wheat with headers of various sizes and different size crews, with man-labour at \$ 2 and horse-labour at \$ 1.20 per day of 10 hours.*

Size of header and crew	Daily cost of operating the outfit			Cost per bushel	
	Total	Man labour	Horse labour	Interest, depreciation and repairs on headers	Based on 21 bushel yield
12-foot, with 5 men and 10 horses (1) . . . . .	\$ 25.40	\$ 10.00	\$ 12.00	(2) \$ 3.40	\$ 1.06 \$ 0.07 —
12-foot, with 6 men and 14 horses (3) . . . . .	32.20	12.00	16.80	(2) 3.40	1.34 — \$ 0.045
14-foot, with 6 men and 12 horses (1) . . . . .	29.75	12.00	14.40	(5) 3.55	1.06 0.07 —
14-foot, with 8 men and 16 horses (6) . . . . .	38.55	16.00	19.20	(3) 3.35	1.35 — 0.046

12-foot, with 5 men and 10 horses (1) . . . . .	\$ 25.40	\$ 10.00	\$ 12.00	(2) \$ 3.40	\$ 1.06	\$ 0.07	—
12-foot, with 6 men and 14 horses (3) . . . . .	32.20	12.00	16.80	(2) 3.40	1.34	—	\$ 0.045
14-foot, with 6 men and 12 horses (1) . . . . .	29.75	12.00	14.40	(5) 3.55	1.06	0.07	—
14-foot, with 8 men and 16 horses (6) . . . . .	38.55	16.00	19.20	(3) 3.35	1.35	—	0.046

(1) Crew made up as follows: 1 driver and 6 horses with header; two header wagons with 2 drivers and 4 horses; 1 man loading wagon and 1 man on stack.

(2) Based on annual duty of 300 acres and 24 acres per day.

(3) Crew made up as follows: 1 driver and 8 horses with header; 3 wagons with 3 drivers and 6 horses; 1 loader and 1 man on stack.

(4) Crew made up as follows: 1 driver and 6 horses on header; 3 wagons with 3 drivers and 6 horses; 1 loader and 1 man on stack.

(5) Based on annual duty of 450 acres and 28 acres per day.

(6) Crew made up as follows: 1 driver and 8 horses on header; 3 wagons with 3 drivers and 8 horses; 1 loader and 2 men at stack.

The cost of stacking is little if any greater than the cost of hauling from shock to the separator when thrashing. Having the grain in stocks ex-

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pedites threshing somewhat and at the same time reduces the number of men and horses required.

*Headers.* — Thousands of acres of wheat are harvested annually by means of the header in the Pacific Coast States and in the Middle West. The sizes of headers most commonly used are 12 and 14 feet. A six-horse team is found most commonly on the twelve-foot machine, although eight horses are sometimes employed where the grain is particularly heavy or where the land is in such condition as to make a very heavy draft. On the fourteen-foot machine eight horses are used most frequently. The approximate cost of harvesting an acre of wheat with twelve and fourteen-foot headers, with two common-size crews each is given in Table IV.

Table IV shows that there is generally a saving in harvesting with a header when the cost of shocking and stacking, or hauling to the separator is considered.

*Combines.* — By far the cheapest method of harvesting and threshing wheat practised in this country at present is by means of the combined harvester, a machine that cuts the heads from the wheat and threshes them at the same operation.

The use of this outfit has been limited to certain sections where the grain ripens on the stalk.

"Combines" as they are commonly called in the sections where they are used, vary considerably in size and weight according to the type and make. The amount of work done per day with the different sized outfits is shown in Table V.

TABLE V. — *Acres cut and bushels threshed by different sized combines in a 10-hour day (15 i. b. bushels).*

Width of combines and horses used	Acres per 10-hour day			Bushels threshed per day (20 bushel yield)	Usual number of men in crew
	Per combine	Per horse	Per foot of cut		
12 feet, 8 horses	12.4	1.55	1.77	372	2
12 feet, 10 horses	13.6	1.36	1.51	398	2
12 feet, 22 horses	10.9	0.90	1.06	307	4 or 5
14 feet, 20 horses	20.6	0.80	1.47	618	5
16 feet, 28 horses	27.0	0.93	1.99	810	5
18 feet, 33 horses	31.0	1.03	1.72	930	5
20 feet, 30 horses	34.0	1.13	1.70	1020	5 or 6
24 feet, 36 horses	32.0	1.17	1.75	1260	5 or 6

There is considerable irregularity in the number of acres cut per day by the different sized outfits, due probably to the small number averaged in most of the groups.

Depreciation, interest on investment, repairs, and operating expenses of these outfits are shown in Table VI and VII.

TABLE VI. — *Overhead expenses per year, per day, per acre and per bushel; average cost and estimated life of and acres cut annually by different sized combines (65 reports).*

Width of swath	Average annual overhead expenses on combines					Total per			Average bushel cos (9 bushel yield)	Estim- ated life in years	Average acres cut annually to date
	Total	Depre- ciation	Interest on investment at 6 %	Repairs	Day	Acre					
	feet	\$	\$	\$	\$	\$	\$	\$			
7	172.49	106.49	33.00	33.00	9.10	0.734	0.0244	1100	10.31	235	
9	184.04	112.04	36.00	36.00	9.30	0.684	0.0228	1200	10.72	269	
12	233.36	115.41	50.55	67.40	8.95	0.450	0.0150	1685	14.60	519	
14	233.31	114.59	50.88	67.84	9.73	0.472	0.0157	1696	14.80	494	
16	209.05	87.95	51.90	69.20	6.58	0.244	0.0083	1730	19.67	858	
18	269.37	127.06	60.99	81.32	8.35	0.269	0.0090	2033	16.00	1000	
20	310.05	146.25	70.20	93.60	7.93	0.233	0.0078	2340	16.00	1330	
24	425.00	250.00	75.00	100.00	8.92	0.213	0.0071	2500	10.00	2000	

TABLE VII. — *Labour costs per day, per acre and per bushel for different sized combines and crews, man-labour being considered as worth \$2 and horse-labour \$1.20 per day of 10 hours (65 reports).*

Width of cut and crews most commonly used with each outfit	Labour cost per day			Labour cost per acre			Total man and horse labour cost per bushel
	Total	Man	Horse	Total	Man	Horse	
		labour	labour		labour	labour	
7 feet; 2 men, 8 horses.	\$ 13.60	4.00	9.60	1.10	0.32	0.78	0.0365
9 feet; 2 men, 10 horses.	16.00	4.00	12.00	1.18	0.30	0.88	0.0392
12 feet; 4 men, 22 horses.	34.40	8.00	26.40	1.73	0.40	1.33	0.0576
14 feet; 5 men, 24 horses.	38.80	10.00	28.80	1.88	0.48	1.40	0.0628
16 feet; 5 men, 28 horses.	43.60	10.00	33.60	1.61	0.37	1.24	0.0538
18 feet; 5 men, 30 horses.	46.00	10.00	36.00	1.48	0.32	1.16	0.0495
20 feet; 5 men, 30 horses.	46.00	10.00	36.00	1.35	0.29	1.06	0.0451
24 feet; 6 men, 36 horses.	55.20	12.00	43.20	1.32	0.29	1.03	0.0438

From these figures it appears that the total cost of cutting and threshing a bushel of grain with a combine varies from about 5.1 cents per bushel for the large outfits to a fraction under 8 cents for the 14-foot size. Six cents per bushel is probably a fair general average cost representing one-third and one-fourth of the cost in sections where the wheat is cut and threshed at two separate operations with a consequent increase in man and horse-labour. At present most combines are still drawn by horses, although auxiliary gasoline engines are frequently used to operate the mechanism, the horses merely moving the outfit. Modern combines are expressly designed and built for the complete operation of cutting and threshing the grain and gasoline engines either in form of tractors or mounted on the combines themselves as single units.

813 - **A Farm Accounting and Statistics Bureau for British Columbia, Canada.**

TWEDDLE, A. B. (Statistician), in *The Agricultural Journal of the Department of Agriculture of Victoria, B. C.*, Vol. 2, No. 10, pp. 197. Victoria, B. C., December, 1917.

The Department of Agriculture of British Columbia, following the example of the Ontario Agricultural College at Guelph, has instituted a Farm Accounting Statistics Bureau for the study of Farm Management, in consideration of the beneficial results similar work has been obtaining in the United States, which proved to be useful not only to farmers themselves but to legislators and colleges as well. It is not intended, nor is it possible at this time, to include all the farmers in the Province, but a limited number will be asked to cooperate with the Department of Agriculture. The necessary diaries and forms will be delivered free of charge to those farmers expressing a willingness to cooperate. In these diaries the farmers will be required to record daily operations and transactions along the lines shown in accompanying forms, which, in brief, relate to crop yields and sales, feed and supplies, fertilizers, live-stock sales and purchases, by-products sales and receipts, expenses of various kinds, capital investment and depreciation, etc. The forms will be distributed merely for the purpose of a guide to the farmers in making entries in the diaries.

The work does not require the knowledge of book-keeping, the farmers being asked to give the simple facts in the diaries. At the end of the twelve months these diaries will be collected by the Department of Agriculture where the data will be compiled.

Such work need not interfere with regular daily duties on the farm, and on the other hand will provide profitable employment for the members of the families for the entire year. All diaries and records will be numbered and so dealt with throughout that during compilation no names will be disclosed to the public, or any member of the Government except the official in charge of the work. Not under any circumstances will the information received by the Department of Agriculture be allowed to be used for any purpose relating to taxation in any form.

Immediately the information has been compiled the diaries will be returned to the farmers, along with a copy of the compiled statements, which may be used for their future reference and guidance.

#### AGRICULTURAL INDUSTRIES.

814 - **The Cream of Tartar in Plastered Vines.** - BORNSTRÄGER, A. I. Plastered Wines and the (Italian) Official Method for Estimating the Cream of Tartar and the Free Tartaric Acid, in *Le Stazioni sperimentali agrarie italiane*, Vol. I., Pt. 11-12, pp. 576-596. Bibliography of 23 Publications. Modena, 1917. - II. On the Yield in Tartarate of Wines Plastered during Winter, *Ibid.*, pp. 610-612. Bibliography of 10 Publications.

I. - After having given an historical review of the question, quoting the chief work done on the subject since PASTEUR, the author describes his own experiments on plastered wines. He has found that the actual yield in cream of tartar during the winter did not agree with the yield calculated by deducting the result obtained in the following spring (March, 1917) from

the result of the estimation of the bitartrate obtained by the alcohol-ether method carried out in autumn (November, 1916). The actual yield found was higher than that calculated by difference.

II.—Wines made from well ripened, white Vesuvius Catalanesca grapes and plastered on pressing gave a higher yield of cream of tartar (1.25 to 1.50, 2.10 times) than that given by control wines made at the same time with similar grapes, but not plastered. For the 1913 wines the results were: — natural, 1.00 %; plastered, 1.26 %; another wine plastered more than the previous one, 1.53 %; and for the 1916 wines: — natural, 0.77 %; plastered, 1.63 %.

**815 The Balance of Some Constituents of the Sugar Beet During the Manufacture of Sugar.**—SAILLARD, EMILE, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 17, April, 607-690. Paris, April 26, 1918.

On account of the increased price of certain constituents of the sugar beet, especially potassium and nitrogen, the author thought it might prove useful to study these constituents during the process of sugar-making. He gives the results of his investigations as the averages of numerous analyses made during about 15 years, and draws from them the following conclusions.

**NITROGEN.**—The nitrogen from the diffusion pulp and carbonated cake may be recovered, but that which is given off as ammonia during the heating of the juice, syrup and cooked mass, which are alkaline, is lost in the condensation waters or the condenser; this represents about 17 % of the total nitrogen.

At the present time almost all the molasses from sugar factories are used for the manufacture of alcohol and brines (the remainder is used for molasses feeds). The nitrogen they contain, representing about 30 % of that of the beet, is lost during the burning of the residue.

About 50 % of the total nitrogen of the beet is, therefore, lost. This loss is equivalent to 2.2 lb. of nitrogen per metric ton of roots, or about £ 2.10 per acre.

**POTASSIUM AND SODIUM.**—These are contained almost entirely in the molasses and brine. Nevertheless some loss occurs during the burning of the residue.

**PHOSPHORIC ACID.**—This remains chiefly in the carbonated cake.

It is seen that as the beet is converted into molasses, then into residue and brine, the quantity of nitrogen per 100 of potassium decreases. For 100 parts of potassium, the beet contains about 75 of nitrogen; molasses 32, distillation residue a little less than 32.

It was once proposed to absorb the ammonia given off by the heated juices with sulphuric acid; at the present price of nitrogen (4s. 9d. as compared to 11 1/2 d. to 1s. 1 1/2 d. before the war) this proposal would be more valuable. The loss of nitrogen during the burning of the residue deserves attention for the same reason.

816 - **Estimation of the Water Content of Products of the Sugar Industry by the Distillation Method.**—**LINDEN**, T. VON DER, **KAUFFMAN**, M., and **LEISTRA**, F. (*Proefstation voor de Java-Suikerindustrie*, *Archief voor de Suikerindustrie in Nederlandsch-Indië*, No. 22, pp. 951-962 + 6 Tables + 1 Fig. Soerabaja, May, 1917).

Apart from JOSSE's well-known method for determining the water content, and consequently also that in dry matter, in agricultural commercial products, there is another, less exact but more rapid, which has been applied in the analysis of matters differing widely one from the other. This method consists in the *distillation* of the matter to be analysed in the presence of a liquid insoluble in water, such as benzene, toluene, xylene, anhyd acetate, paraffin, etc. The steam, carried over with the other vapours is condensed in a eudiometer, thus allowing the water content of the product analysed to be determined immediately. GOGELA applied this method to the analysis of products of the sugar industry in 1915 (*Centralblatt für die Zuckerindustrie*, p. 228, 1915).

The work on this subject is first reviewed, including that of HOFFMANN, the first to apply the method; GRAY, who applied it to the analysis of butter and other food-stuffs, using as insoluble liquid, acetate, valerianate or anhyd butyrate; MARCASSON (fat, mineral oils, soap and resins); THÖRNER (butter, margarine, meat, milk, vegetables, bread, flour); GRÄFE and SCHWALBE, MAI and RHEINBERGER who used paraffin for fibrous matter and cheeses; FABRIS, with essence of turpentine, for honey; GÄDTLER, with benzene, for cheese, white of egg, etc.; MICHEL, who made a close study of the method and found that the best results were obtained with a mixture of toluene and xylene as an insoluble liquid.

The authors studied at the Experiment Station of Java the application of this method to the products of the sugar industry and compared their results with those obtained by JOSSE's method. They concluded that :

1) *With benzene* distillation is too slow, and necessitates the use of too large a quantity of distilled liquid, which remains cloudy; this justifies the opinion of MICHEL who recommended the use of an insoluble liquid lighter than water and with a higher boiling point.

2) *Paraffin* can hardly be recommended because it causes reactions and then shows too high a water content.

3) *Toluene* gives good results, though it is still necessary to collect excessive quantities of the distilled liquid.

4) *Xylene* is the best liquid; it allows an easy and rapid distillation, and relatively small quantities may be used. According to the author, the mixture of xylene and toluene advised by MICHEL is not appreciably superior to xylene used alone.

Various analyses of molasses made with the use of xylene gave results agreeing with those of other methods so long as certain precautions were taken and corrections made:—1) Readings from the eudiometer a quarter of an hour and an hour after distillation (the average value between the two readings always corresponds best to that obtained by other methods); 2) correction of errors caused by the meniscus of the eudiometer.

The authors do not consider it advisable to adopt this method generally for the analysis of products of the sugar industry, but it gives practical results of sufficient exactitude to be applied now and again, on account of its rapidity, in laboratories where numerous determinations of water content have to be made.

817 - **Bacterial Deterioration of Bread in Rome.** — PEROTTI, R. and COMANDUCCI, J., in *Atti della Reale Accademia di Lincei*, 5th. Series, *Rendiconti, Classe di Scienze Fisiche, Matematiche e Naturali*, Vol. XXVII, Pt. 7, pp. 258-261, Rome, April 7, 1918.

In the spring of 1917 a ropiness was observed in the bread of some bakeries in Rome which was attributed by the authors to a form resembling *Bacillus mesentericus vulgaris* Flügge, perhaps identical with VOGEL's *Bacterium mesentericum*, and differing slightly from FÜHRMANN's *Bacterium parisi*. The chief condition under which this deterioration occurs is the chemical composition of the flour. The agent, at least in the case studied by the author, is infected yeast. To avoid the injury it is necessary to disinfect the vessels and the rooms in which infection has occurred, use controlled, well-prepared yeast, and keep the bread at a rather low temperature.

With reference to another deterioration of bread caused by *Oospora variabilis* and studied by one of them (1), the authors note that the organism survives baking much more frequently than had been supposed, and that this must be borne in mind, not only to obtain good bread, but also to prevent the spread of organisms of infectious diseases.

818 - **The Agen Plums and Prunes.** — CARLES, P., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 13, pp. 420-432, Paris, April 10, 1918.

The author (fellow of the Faculty of Medicine and Pharmacy of Bordeaux) summarises a pamphlet published by him under the title of "The Agen Plum and Prunes". In the preparation of the Agen prune there are four chief points for the biologist to consider:— 1) the destruction of the relative tartness of the ripe fruit; 2) its desiccation; 3) elimination of moulds; 4) constant preservation of its normal water content.

*1st. Phase.* — The action is exclusively *chemical* or, more correctly, *biological*. The agent is an oxydase which, when helped by gentle heat and a moisture-saturated environment, quickly destroys the tannic matter, ferrous salts, etc., and changes the fruit juice into a very delicately flavoured and sweet juice.

*2nd. Phase.* — This is purely *physical* and consists of the transformation of the juice into a true syrup by the elimination of its excessive water. To do this the temperature is gradually and regularly raised while a drying air current is set in motion. The process must be stopped at the moment when the remaining sugar transforms this intracellular juice into an ordinary preserving agent, an auto-antiseptic. The prune is ready when the natural moisture is thus reduced to 30 %.

*3rd. Phase.* — These are various methods of eliminating moulds and the author discusses their scientific side.

(1) See *R.* Sept., 1917, No. 532, *I.J.*

*4th. Phase.* — Dryness must be avoided. When, to eliminate the danger from moulds, the 30 % moisture content is by chance allowed to fall too low the sugar of the normal syrup crystallises on the surface. The fruit turns first grey, then white, like figs, and loses its plasticity, delicate flavour and 50 % of its commercial value. If the sterilised prune with its normal water content is placed where the water cannot evaporate, it will keep its qualities indefinitely. It is yet better to pass a well-adjusted supply of hot steam into a store where evaporation is very slow; by this means the moisture equilibrium is re-established and the prune assumes the black colour characteristic of its normal water content.

Producers, buyers and exporters should give greater attention to selecting varieties instead of sacrificing all else for the weight of the fruit. Weight is far from being a definite proof of the excellent quality of certain plums with small, light yellow stones and greenish-yellow flesh of average volume. The smell of these varieties is so pervasive, yet so delicate, that when the fruit is eaten the smell spreads all around.

819 — *The Pasteurization of Sour, Farm-skinned Cream for Buttermaking.* — HUNZIKER, O. F., SPRINGER, MILLS, H. C. and SWITZER, H. B., in *Purdue University Agricultural Experiment Station, Bulletin No. 268*, Vol. XX, pp. 76, 54 Tables, Lafayette, Ind., September, 1917.

The purpose of the experiments recorded in this bulletin was:—

- 1) To determine the effect of pasteurization of sour, farm separator cream on the flavour, keeping quality and market value of butter.
- 2) To study the effect of different processes of pasteurization on the bacterial count of cream and butter and on the flavour and keeping quality of butter.
- 3) To study the effect of pasteurization on the chemical properties of fresh and stored butter.
4. To determine the causes undertaking the changes of the flavour of raw and pasteurized cream butter in storage.

The results are summarized as follows:—

Fresh butter made from sour cream pasteurized at 145° F. and held for 20 minutes, scored 2.9 points higher than fresh butter made from raw sour cream. Fresh butter made from sour cream pasteurized at 165° F. flash and at 185° F. flash respectively, scored practically the same as fresh butter made from raw sour cream.

After 30 days cold storage, the butter made from sour cream pasteurized at 145° F. holding, and 165° F. and 185° F. flash process, scored 3.9 points, 2.0 points and 2.4 points higher, respectively, than the butter made from raw sour cream.

After 90 days storage, the pasteurized cream butter scored 4.5 points, 2.9 points and 3.2 points, respectively, higher than butter made from raw cream.

On the basis of a difference of two cents between extras and firsts, and two cents between firsts and seconds, and assuming that extras are worth 30 cents, the holding process butter would sell at 1.6 cents, 1.7 cents, 1.7 cents and 2.0 cents higher when fresh and when 30, 60 and 90 days old, res-

pectively, than the raw cream butter. On the same basis, butter from the flash process at 185° F. would sell at 0.2 cent, 0.9 cent, 1.1 cents and 1.3 cents higher when fresh and when 30, 60 and 90 days old, respectively, than raw cream butter.

The holding process at 145° F. for 20 minutes proved more efficient in its germ killing effect than either of the two flash processes, averaging a germ killing efficiency of over 99.9 per cent. The flash process at 185° F. showed a slightly lower germ killing efficiency than the holding process, and the 165° F. flash process had a germ killing efficiency of not more than 90 per cent. The minimum temperature and time at which the holding process insures maximum germ killing efficiency and keeping quality is 145° F. for 20 minutes. Nothing is gained by longer exposure to 145° F.; in fact, excessive exposure is undesirable, because it tends to give the butter a mealy body.

The butter made from cream pasteurized at 185° F. flash showed the best keeping quality. This is probably due to its power, not only to destroy germs, but also to inhibit the action of enzymes.

The 185° F. flash process proved unsuitable for pasteurization of sour cream, causing the butter to have a distinctly oily flavor. This appears to be due to the combined action of high heat and high acid. In the case of sweet cream or sour cream in which the acid has been properly reduced by neutralization before pasteurization this oily flavor is much less pronounced.

The germ killing efficiency of pasteurization in summer is greater and the keeping quality of such butter is better than that of winter cream and butter showing that winter cream contains more resistant and undesirable fermentations than summer cream.

The quality and sweetness of cream affect both raw and pasteurized cream butter, but pasteurization is capable of producing marked improvement in the quality of butter even from inferior cream.

In order to reap the full benefit of pasteurization, cream and butter must be guarded against re-contamination after pasteurization. An unclean vat may reduce the efficiency of pasteurization 50 per cent. Pure air, sanitary condition of sewers, freedom of the factory from flies, cleanliness of vats, pipes, conduits, coolers and churning, purity of starter and wash water, and the sanitary condition of the packing equipment are all essential in safeguarding the benefits of pasteurization.

When cream is put in proper condition for pasteurization, and other conditions are as they should be, there is no danger of excessive loss of fat in the buttermilk from pasteurized cream. Pasteurization of mixed sweet and sour cream without giving the acid in the sour cream time to act normally on the curd in the sweet cream, pasteurization of excessively thin sour cream, the churning at too high temperatures or not holding the cream long enough at the churning temperature, and the overcrowding of the churn, are bound to reduce the exhaustiveness of the churning and to cause heavy loss of fat in the buttermilk.

Pasteurization does not materially effect the chemical composition of butter. It has a tendency, however, to lower slightly the per cent moisture

curd and acid in butter. During storage, the per cent. lactose in butter decreases and the acidity increases. These changes are greater in raw cream butter than in pasteurized cream butter. The increase in acidity is not proportionate to the decrease in lactose. The fat constants in butter in storage undergo but very slight changes. These changes are greater in raw cream butter than in pasteurized cream butter, but they are too far within the limits of experimental error to permit of serious comparison. The fat constants in butter fat held at room temperature for 11 months showed slightly greater changes, but even these changes were in no way commensurate with the intense deterioration of the flavour of the fat. These results suggest the probability that some of the flavour defects in storage butter may be due, at least in part, to hydrolysis or oxidation of some of the fats and that very slight changes in the fat constants may create most intense depreciation in the flavour of butter fat and butter.

All butter held in cold storage showed an increase of cleavage products of the proteins as determined by proteins not precipitated by bromine, copper sulphate, phosphotungstic and tannic acid. This increase in protein decomposition was much more rapid after butter had been transferred from cold storage to room temperature. The protein decomposition was greatest in the raw cream butter and least in the butter made from cream pasteurized at 185°F. flash process, showing that this process proved most efficient in retarding protein hydrolysis, probably due to its power to destroy the activity of enzymes contained in cream. Protein hydrolysis in butter may be brought about by such agents as ferment, both micro-organisms and enzymes, acids, salts and metals through catalytic action. Cream of poor quality and old cream furnish favourable conditions for rapid protein hydrolysis in butter. Protein hydrolysis plays a prominent part in the deterioration of butter in storage. It can be minimized by improving the quality of the cream, proper pasteurization, reduction of acidity, discarding of rusty cans, protection of cream and butter against contamination with metals and metallic salts, sanitary equipment, thorough washing of the butter, proper treatment of liners and wrappers, cleanliness of packing and printing equipment and guarding butter against exposure to high temperatures in storage and in transit.

820 - A Substitute for Rennet Extracted from the Berries of *Solanum eleagnifolium*. — See No. 715 of this Review.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

821 - **Sooty Moulds of Southern France.** — ARNAUD, G., in the *Bulletin de la Société de Pathologie végétale de France*, Vol. IV, Part 2, p. 95. Paris, 1917.

The author gives the results of his observations on sooty moulds collected by M. MAZADE at Mougins (Alpes Maritimes), etc., in March, 1915.

On branches of olive attacked by *Lecanium oleae* were perithecia of *Capnodium meridionale*, already reported on various plants.

Branches of fig heavily attacked by *Ceroplastes rusci* were covered with numerous perithecia of *Ceratocarpia Cactorum*; the same fungus was also very abundant on the branches and less commonly on the leaves of the orange tree. The latter plant was chiefly attacked by *Lecanium hesperidum* with a few *Pulvinaria camellicola*. Up to the present the fungus had never been reported on the leaves.

The perithecia of the two species in question were often accompanied by the pycnidia and elongated spermagonia found in the majority of the sooty moulds.

This information shows that the sooty mould fungi are not in close relation with any particular species of plant or honeydew-producing insect.

822 - **Simple Solutions of Copper Sulphate against Vine Mildew.** — CAMPRÉDON D'ABARETTO, E., in *Annali della R. Accademia d'Agricoltura di Torino*, Vol. XI, (1917), pp. 13-19. Turin, 1918.

At Ponzano Monferrato (province of Alexandria) the author carried out spraying experiments to compare the action and efficiency of Bordeaux mixture containing 1 % copper sulphate and 1 % lime with those of a simple solution of copper sulphate containing 250 gm. of sulphate per hectolitre of water and made adhesive by the addition of 500 gm. of dextrin previously dissolved in hot water. The results showed that simple 2.5 % solutions of copper sulphate are more efficient and act more rapidly than those of Bordeaux mixture. Nevertheless, even when dextrin is added to these simple solutions to make them more adhesive and to increase the duration of their action, this action decreases rapidly and a few days after spraying the vines have as low a resistance to adverse conditions and attacks of mildew as those treated with ordinary Bordeaux mixture.

Simple 2 %<sub>00</sub> solutions can, therefore, be used as a rapid cure, but Bordeaux mixtures containing 1 % copper sulphate and 1 % lime have a more lasting and more certain preventative action.

From these results the author deduces the following practical rules:—

Simple solutions are not to be recommended in the ordinary control of mildew because of the short duration of their action, which though very effective immediately after spraying, weakens rapidly and disappears in a few days, leaving the vines unprotected. They should only be used in exceptional cases, especially for treating large vine-growing areas when mildew appears suddenly and labour is lacking, as they rapidly check the attack. Once infection has been stopped by easy and economical spraying with a simple solution there is ample time to spray again with Bordeaux mixture, the application of which is slower and more expensive, the curative action slower, but more lasting and capable of protecting the vine against subsequent attacks of the disease.

823 — **Patents for the Control of Diseases and Pests of Plants.** — See No. 896 of this *Review*.

824 — **Diseases and Pests of Sorghum in Kansas, U. S. A.** — See No. 769 of this *Review*.

825 — **Diseases of Parsnips in England.** — COTTON, A. D., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 1, pp. 8-21 + 2 Figs + 2 Plates. London, 1912.

The attention of the Board of Agriculture and Fisheries was recently drawn to a disease of the roots of parsnips (*Pastinaca sativa* = *Peucedanum sativum*) well known to English farmers as "parsnip canker", or "parsnip rust". This disease does not appear to have been studied hitherto.

The very serious loss in roots, especially in Worcestershire, and also in Gloucestershire and Somersetshire, lead to a careful investigation. Two visits were paid to the district most affected (that of Evesham, Worcestershire). Besides field observations, experiments were made at Kew with diseased roots and infected soil from Evesham and Somersetshire. At the same time certain secondary diseases of the parsnip were noted, three of which are new for Great Britain, and one of which appears capable of causing serious damage.

Parsnip canker, *i. e.*, the decay of the upper part of the roots during late summer and autumn, is caused by a physiological phenomenon which cracks the outer skin, and not by invasion by a parasitic fungus. The cracks occur during growth, especially when heavy rain follows a period of drought; the parts attacked are the periderm and the outer layers of the cortex. The cracks, mainly horizontal round the upper part of the root but also vertical, are from  $\frac{1}{2}$  to 2 inches long, and expose the cortex. The resulting canker or decay is caused by the inability of the root to form a layer of wound cork. Although the outer cortical cells exposed to the air suberise and there are but few cell divisions, no definite phellogen is formed and the cracks are not protected as in the case of other fleshy roots. The protection is insufficient to keep out micro-organisms, which probably

enter by the inter-cellular spaces and cracks caused by drying and destroy the tissues of the root more or less rapidly. Although canker is more serious in some districts than others, it seems to occur everywhere as a result of the cracking of the root-skin. No specific microorganism has been isolated in connection with this decay.

With respect to the conditions causing the formation of cracks, investigations show that while these cracks are due to an unequal rate of growth of the tissues—the inner tissues growing more rapidly than the outer ones—and are largely influenced by weather conditions, their formation may be favoured by certain methods of culture, chiefly over-manuring, neglect of liming and early sowing, which causes premature ripening. The variety of parsnip grown may also be responsible for the appearance of the disease, a high quality parsnip with bulky top, abundant flesh, and small core being very largely grown in the worst infected areas.

As preventative treatment it is advisable:—1) to avoid growing parsnips in too rich a soil, 2) to sow late, 3) not to neglect liming, 4) to apply potash and salt to the soil to retard ripening, 5) to adopt a suitable rotation, never growing parsnips two or three consecutive years on the same land.

Besides canker, parsnips are attacked by the following diseases:—

1) *Erysiphe Poligoni* D. C., a fungus occurring in large numbers in market gardens round Evesham and Wisbech, and elsewhere; the attack is not sufficiently severe to call for special treatment.

2) *Phyllachora Pastinaceae* Rostr.; a species new to Britain; the conidial form (*Cylindrosporium Pastinaceae* Lind.) attacked very severely the foliage of a certain number of parsnips in a market garden at Mickleton (Glos.). Although neither the ascigerous nor conidial stage of *Phyll. Pastinaceae* had been previously reported in the country, there is little doubt that it occurs frequently but has been overlooked. It is also probable that *Phyll. Pastinaceae* is synonymous with *Phyll. Heraclci*, a fungus not uncommon in England on cow parsnip, *Heracleum Sphondylium*. There is no doubt that the parasite passed from the wild to the cultivated plant.

3) *Ramularia Pastinaceae* Bubák, new to Great Britain, found on parsnip leaves generally in Worcestershire, but also in Gloucestershire and Cambridgeshire. It is probably spread widely over England, but has been overlooked. In crowded gardens and allotments the fungus weakened the plants considerably, but in the open fields the damage was insignificant.

4) *Cercospora Pastinaceae* Karst., new to Great Britain; found on parsnip leaves closely associated with *Ramularia Pastinaceae*, but much less common than this fungus.

5) *Plasmopara nivea* Schröet., a species observed in large numbers on parsnip leaves near Wisbech at the end of September, 1917. In October it was found on material from Ashford and Haslemere, and later signs of its presence were noted in several other localities. In a garden near Wisbech where parsnips were grown between trees a considerable amount of the foliage was destroyed by this fungus.

826 - The Control of a Disease of the Japanese Medlar caused by *Fusicladium piritinum* var. *Eriobotryae* (1). — SAVASTANO, L., in the *R. Stazione di Agricoltura e Frutticoltura, Acireale, Bollettino* No. 33, pp. 2. Acireale, 1918.

In 1917-18, the experiments with lime-sulphur mixture, begun in 1916 to attempt to control the disease (called "brusone" by the author) were continued.

Summer sprayings were tried, with the object of controlling the disease in the branches, as well as 2 winter sprayings for the purpose of protecting the medlars from the parasite.

As the result of these experiments, the following method is advised for the treatment of the disease :—

1) Summer spraying: in August, with 10-12 % lime-sulphur mixture, normal density 1.25; this spraying is only given when the disease is present in the branches.

2) Winter sprayings. The first at the end of December or beginning of January, *i. e.*, when the disease begins to appear, and the second in February; both of 1.2 %, normal density.

The spray should be applied liberally so as to wash the vegetative parts requiring protection against the fungus.

827 — Larch Canker (*Dasyscypha Willkommii*) in Sweden. — See No. 771 of this Review.

#### INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

828 — The Value of the Coleopteron *Chilocorus bipustulatus* as a Destroyer of Scale Insects (1). — CORTE, J., in *Bulletin de la Société Pathologique de France*, Vol. IV, Pl. 2, pp. 86-88. Paris, 1917.

The author collected notes on the attack of the ladybird *Chilocorus bipustulatus* L. on the scale insect *Chrysomphalus dictyospermi* Morg., which is becoming a serious pest in eastern Provence on account of the swarms in which it occurs. His observations do not agree with those of TRABUT, according to whom the ladybird, in Algeria, attacks nearly all scale insects, especially *Ceroplastes rissei* L. of the fig tree, and is able to prevent *Aspidiota hederae* V. Blot from ruining the carob crops.

The author first observed *Chilocorus* larvae and adults feeding on *Chrysomphalus dictyospermi* on a mandarin tree in a garden at Nice, as well as on a neighbouring orange tree. In another garden near the same species was found on a clump of rose-bay the leaves of which were covered with the scale. The research included direct observation and breeding of the insect. Direct observations could only be made during July and were frequently interrupted. During this time *Chil. bipustulatus* was the only coccinellid observed on the mandarin tree and continued to live on it. *Toxoptera aurantii* Fonsc. attempted to invade the bush several times: very small colonies of the aphid formed at the extremities of the twigs.

(1) See *R.*, May, 1918, No. 500. — (2) See *R.*, May, 1915, Nos. 451 and 452; *R.*, March, 1916, No. 368; *R.*, June, 1916, No. 707; *R.*, Oct., 1916, No. 1146; *R.*, July, 1917, No. 691; *R.*, Jan., 1918, No. 118. (*F.I.*)

under the very young leaves which curved round them. These small colonies were destroyed as soon as they appeared, not one being able to establish itself on the tree under observation. The author was unable to catch the ladybird in the act of destroying the insect, but the relative abundance of *Chilocorus* on the bush and the absence of any other coccinellid seem to leave no doubt that the destruction was due to this coleopteron.

If this be correct it shows that the scale is not the food preferred by the ladybird, which only attacks *Crysomphalus* when its customary food is lacking. Nevertheless *Chilocorus* is not considered a large eater of aphids. On the other hand there were on the mandarin tree some specimens of *Saissetia oleae* Bern. in various stages of development, but none appeared to be attacked. The same thing applies to some *Pseudococcus adonidum* (L.) Westw. which the author brought into contact with the ladybird, which seemed to ignore them. It was also noted that *Crysomphalus* multiplied actively on the mandarin tree and rose-bay under observation, especially on the bay, in spite of the many ladybirds on them.

The author placed four specimens of *Chilocorus* in a large tube and fed them with rose-bay leaves on which were *Crysomphalus*. With the help of a magnifying glass it was easy to see how the ladybirds attacked the scale insects. They attack the edge of the shield, break it, and feed on the exposed body of the female. Sometimes the *Chilocorus* specimens were not fed for two or three days. Under these conditions they were seen on one occasion to make vain attempts to break the edge of the shield of large *Ceroptres sinensis* Del Guercio, which they would certainly not have touched had they not been starving. On the other hand, some weeks later, young *Ceroptres* mixed with *Crysomphalus* were continually left untouched in spite of their thin shields. This also happened in the case of young *Ps. adonidum*, but *Asp. hederae* was found to be a very acceptable food.

The observations, started during the first fortnight of July, were still being continued during the beginning of December, when two of the lady birds died and the appetites of the two others decreased considerably. After the end of December they only received scale insects on ivy, and died in the middle of April.

The direct observations and breeding tests therefore proved that, in the Nicc district, *Chil. bipustulatus* attacks *Chrys. dictyospermi*, which suffices to keep it in normal condition, but does not appear to be its normal food. Agriculturists cannot rely on *Chil. bipustulatus* for the efficient control of swarms of *Chrys. dictyospermi*.

829 — The Toxicity to Insects of Various Organic Compounds. — See No. 774 of this Review.

830 — *Dysdercus scassellatii* n. sp., a Bug Observed on Cotton in Southern Italian Somaliland. — DEL GUERCIO, G., in *L'Agricoltura coloniale*, Year XII, 1st Half-Year, No. 1, pp. 5-20, 6 Figs. Florence, 1918.

A detailed morphological description of the new species *Dysdercus scassellatii* (Hemiptera Heteroptera), collected on cotton in southern Italian Somaliland by Dr. G. SCASSELLATI-SFORZOLINI.

Up to the present there has been no precise information as to the biology of the hemipteron.

In some nymphs of this *Dysdercus* some unidentified forms of myctozoa have been found, as well as two different bacteria not yet identified. No internal parasite was found in the nymphs and adults examined.

Together with the nymphs were sent rare forms of large spiders, regarding whose importance, according to the author, nothing definite can be said.

831 - *Megastigmus ballestrerii*, a Hymenopteron Living on the Pistachio Tree and Turpentine Tree, in Sicily. — DE STEFANI, T., in the *Boletino di studi ed informazioni del R. Giardino coloniale di Palermo*, Vol. IV, Pt. 1-2, pp. 101-131 + 24 Figs. Palermo, 1917.

After reviewing the various insect and arachnid pests attacking the pistacchio tree (*Pistacia vera*) and turpentine tree (*P. Terebinthus*, used not only a stock, but also for fertilising the pistacchio) in Sicily, the author confines himself more particularly to the chalcid *Megastigmus ballestrerii* Rond. (syn. *Trogocarpus ballestrerii* Rond.).

The larva of this insect, called by the author "verme dei frutti del pistacchio", destroys the pistacchio seed. In 1916 more than 70 % of the fruit were lost by the action of *M. ballestrerii* in some plantations.

The morphology of the insect is minutely described and information on its biology and habits given. The author believes its natural host to be the turpentine tree, and that it has gradually adapted itself to the pistacchio.

The best method of controlling *M. ballestrerii* is to collect carefully and burn all infected pistacchio fruit either on the plant or on the ground; such fruit is easily recognisable.

To prevent contamination the same procedure should be applied to the fruit of all turpentine trees in or near pistacchio plantations. As the collection of the small turpentine fruit from the tree and the ground would be very difficult, the author recommends the destruction of the female inflorescences in April and May as a quicker and more certain method.

[830-831]